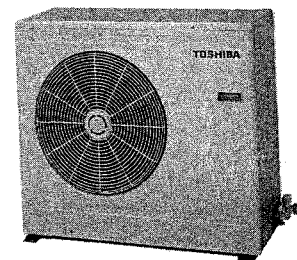
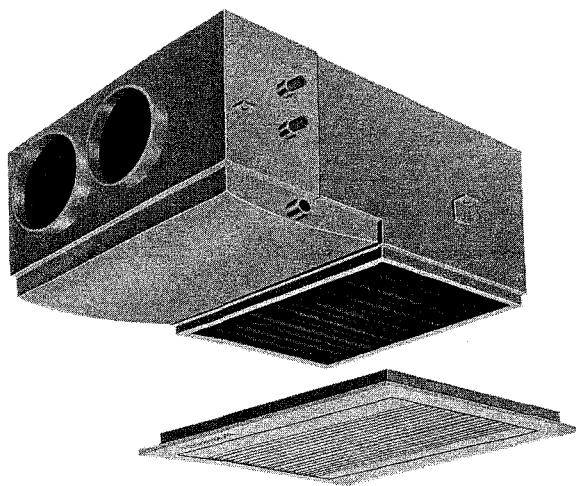


SERVICE DATA
FILE NO. 300-958

TOSHIBA

AIR-CONDITIONER SPLIT (BUILT-IN DUCT TYPE) HEAT PUMP

RAV-161BH-P/160AH-P



Specifications are subject to change without notice.

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1. SPECIFICATIONS

ITEM			MODEL	RAV-161BH-P	
Cooling capacity		*1	kcal/h	4,000	
			BTU/h	16,000	
			kW	4.7	
Heating capacity		*2	kcal/h	4,300	
			BTU/h	17,200	
			kW	5.0	
Power source			Phase	1	
			V	220/240	
			Hz	50	
			COOLING	HEATING	
Power consumption			kW	2.3	2.2
Power factor			%	90	90
Running current			A	11.1	10.6
Starting current			A	60	
Operating noise (SPL)	Indoor unit		dB(A)	42/39/36	
	Outdoor unit		dB(A)	50	
Refrigerant	Name of refrigerant			R-22	
	Charge volume		kg	1.6	
	*Add. volume (20-30m)		g/m	35	
Refrigerant control				Capillary tube & Expansion valve	
Interconnection pipe	Larger side size		mm (in.)	ø12.7	
	Coupler style			Flare	
	Smaller side size		mm (in.)	ø6.4	
	Coupler style			Flare	
	Standard length		m (ft)	5 (16.4')	
	Maximum length (of one way)		*3 m (ft)	30 (98.4')	
	Maximum height				
	Indoor unit higher		m (ft)	15 (49')	
	Outdoor unit higher		m (ft)	30 (98.4')	
Condensate drain pipe diameter				ø32 (OD)	
INDOOR UNIT Model				RAV-161BH-P	
Appearance colour				Black (Zinc galvanized steel + Thermal insulator)	
Dimensions	Height		mm (ft-in.)	320 (1'-19/32")	
	Width		mm (ft-in.)	700 (2'-3-9/16")	
	Depth		mm (ft-in.)	800 (2'-7-31/64")	
Net weight			kg (lbs)	39 (86)	
Heat exchanger type				Finned tube	
Indoor fan type				Multi-blade fan	
Air volume			m³/h (CFM)	840 (494)	
Fan motor output			W	60	
External static pressure	Standard		mmAq	4	
	Max. motor		mmAq	10	
CEILING PANEL Model				RBC-B161PE(W)	
Appearance colour				Silky mist (Munsell 1Y8.9/0.5)	
Dimensions	Height		mm (ft-in.)	40 (1'-37/64")	
	Width		mm (ft-in.)	780 (2'-6-45/64")	
	Depth		mm (ft-in.)	500 (1'-7-11/16")	
Net weight			kg (lbs)	4 (8.8)	
Air filter				Washable	
OUTDOOR UNIT Model				RAV-160AH-P	
Appearance colour				Bronze white (Munsell 6Y7.5/1)	
Dimensions	Height		mm (ft-in.)	740 (2'-5-1/8")	
	Width		mm (ft-in.)	880 (2'-10-5/8")	
	Depth		mm (ft-in.)	310 (1'-3/16")	
Net weight			kg (lbs)	61 (134)	
Heat exchanger type				Finned tube	
Outdoor fan type				Propeller fan	
Fan motor output			W	39	
Compressor	Model			PH230X3-4LS	
	Output		kW	1.5	
Safety device				High pressure switch, Fuse, Bimetal thermostat, Crankcase heater, Overload relay	
Flexible duct				RBC-FD202E	
Blowout unit				RBC-BU1E(W)	
Suction canvas				RBC-CA161BE	
Long-life filter kit				RBC-LK161BE	

Specifications are subject to change without notice.

Note 1: Cooling capacity is based on the following temperature conditions.

Indoor air inlet temperature: 27°C DB (80°F DB)
19.5°C WB (67°F WB)
Outdoor air inlet temperature: 35°C DB (95°F DB)

Note 2: Heating capacity is based on the following temperature conditions.

Indoor air inlet temperature: 21°C DB (70°F DB)
Outdoor air inlet temperature: 7°C DB (45°F DB)
6°C WB (43°F WB)

Note 3: These mean actual length.

Note 4: Operating range of the units

Indoor air temperature

When cooling

Maximum 32°C DB, 22.5°C WB (90°F DB, 73°F WB)
Minimum 18°C DB, 15.5°C WB (65°F DB, 60°F WB)

When heating

Maximum 29°C DB (84°F DB)
Minimum 15°C DB (59°F DB)

Outdoor air temperature

When cooling

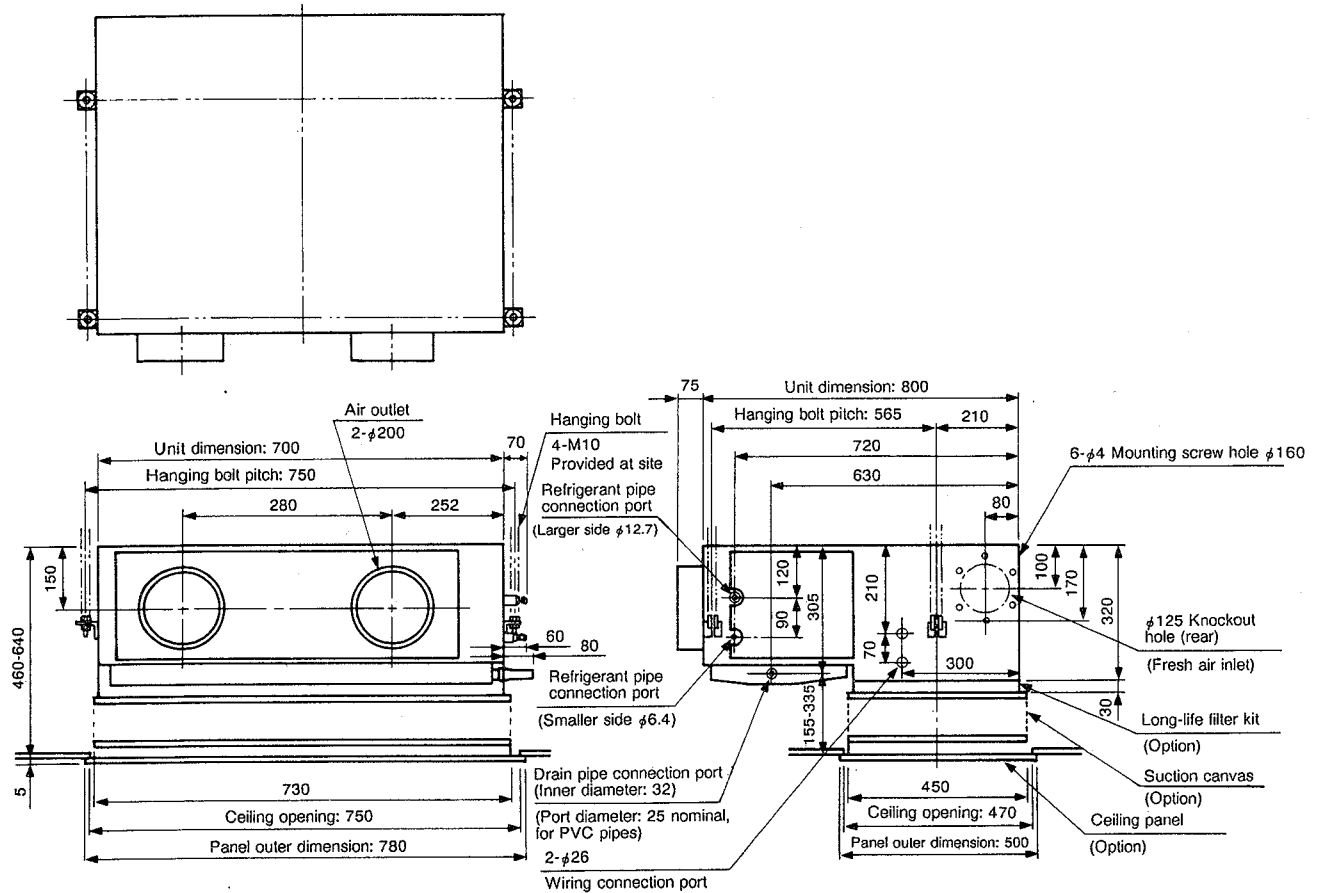
Maximum 43°C DB, 25.5°C WB (109°F DB, 78°F WB)
Minimum 10°C DB (50°F DB)

When heating

Maximum 21°C DB, 15.5°C WB (70°F DB, 60°F WB)
Minimum -10°C WB (14°F WB)

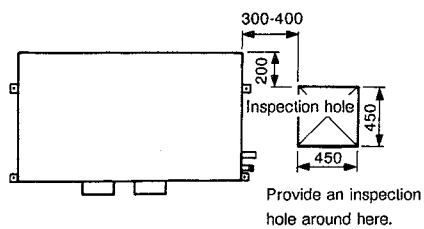
2. CONSTRUCTION VIEWS

2.1 Indoor unit

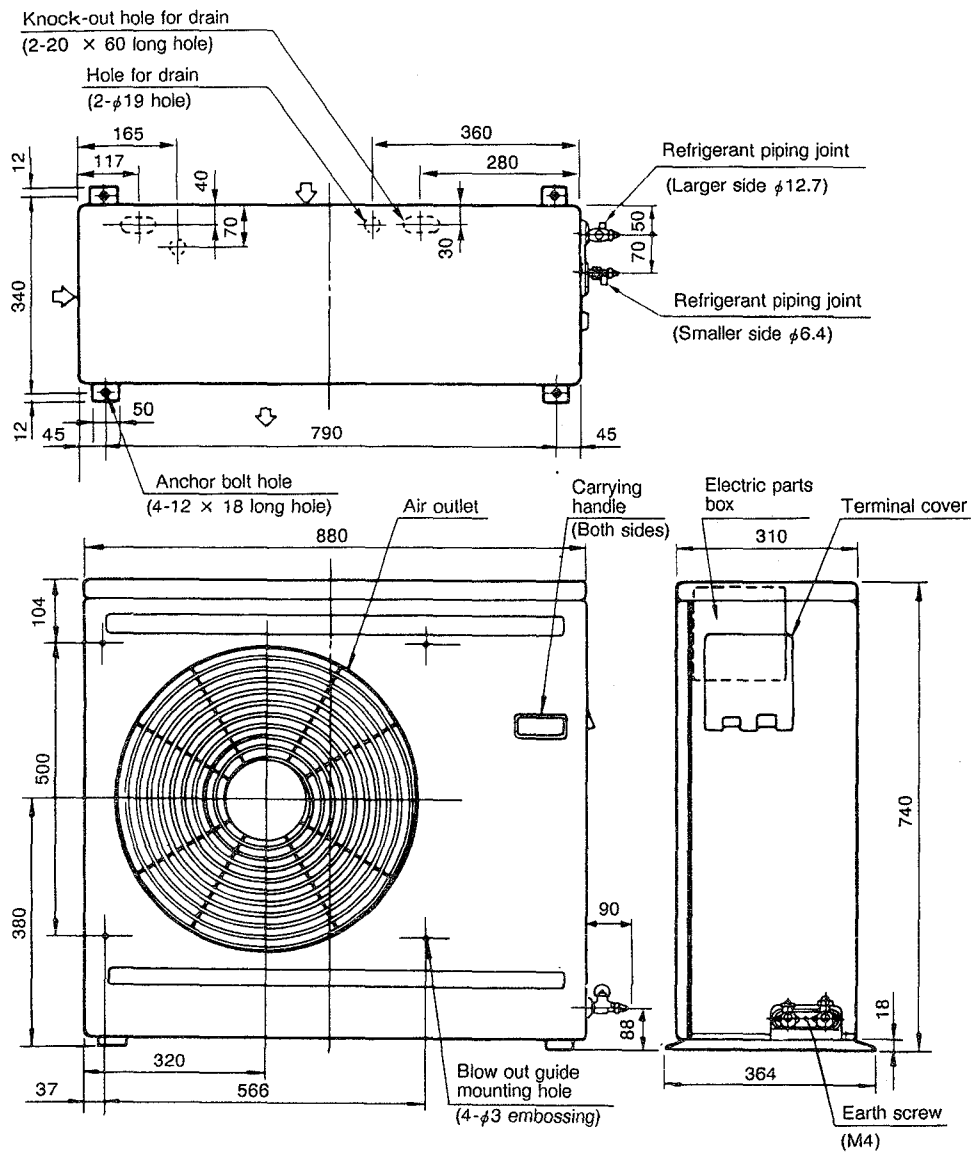


Ensure that there is sufficient space around the indoor units for installation and servicing.

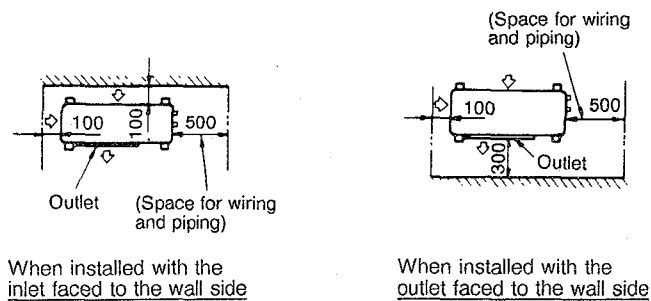
[Indoor unit]



2.2 Outdoor unit

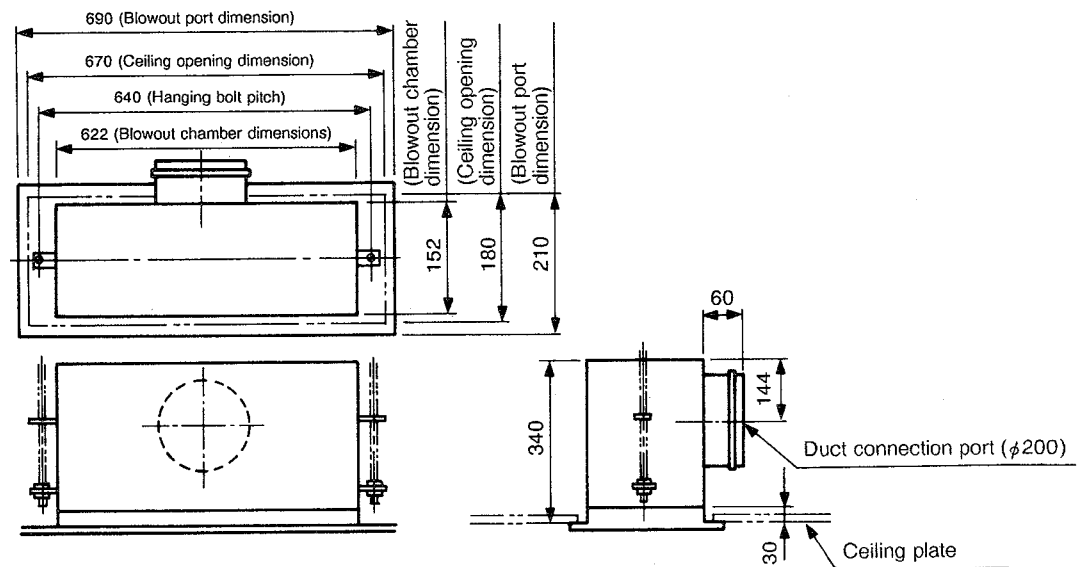


Space required for service

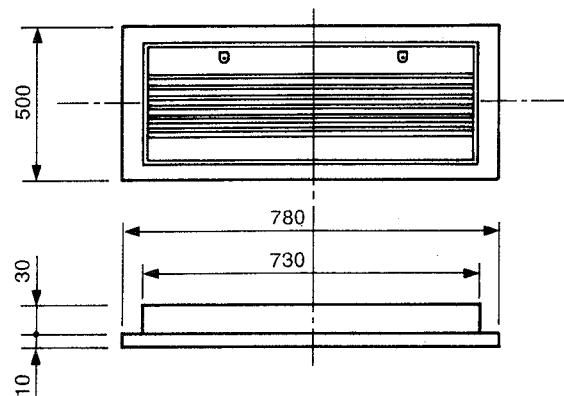


2.3 Optional accessories

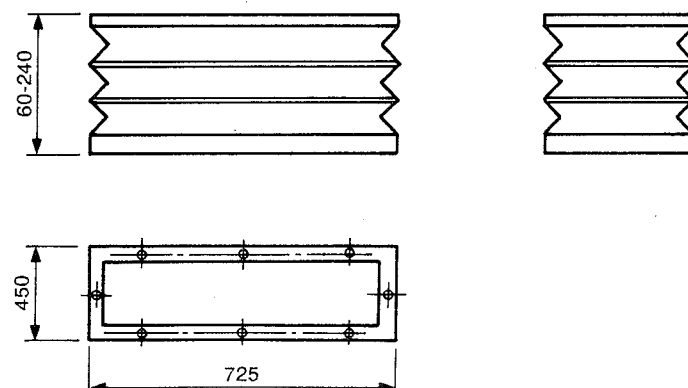
Blowout unit RBC-BU1E(W)



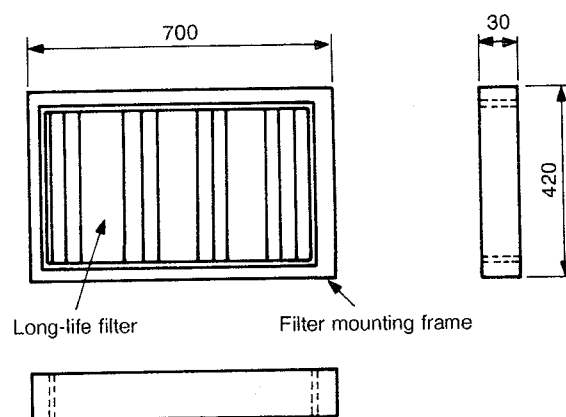
Ceiling panel RBC-161PE(W)



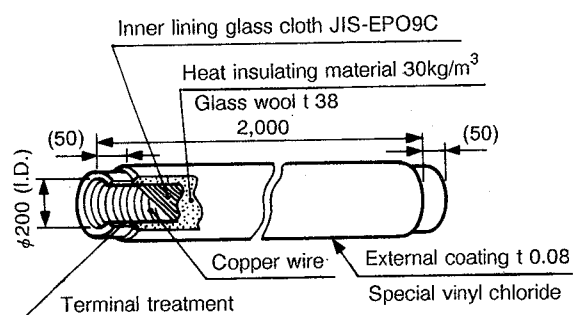
Suction canvas RBC-CA161BE



**Long-life filter kit
RBC-LK161BE**

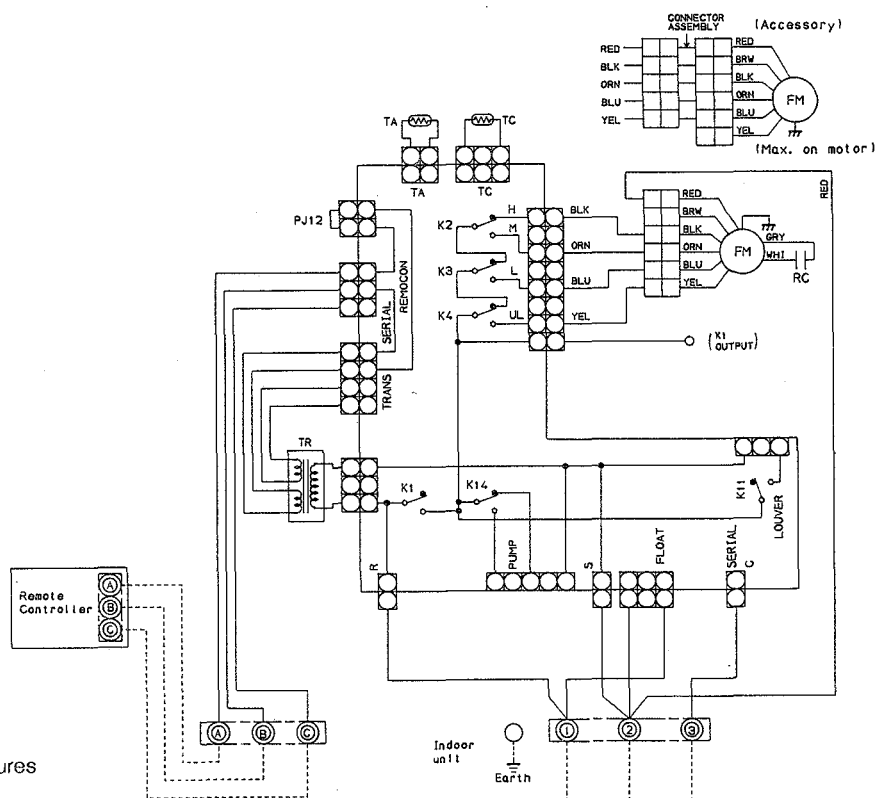


**Flexible duct
RBC-FD202E**



3. WIRING DIAGRAM

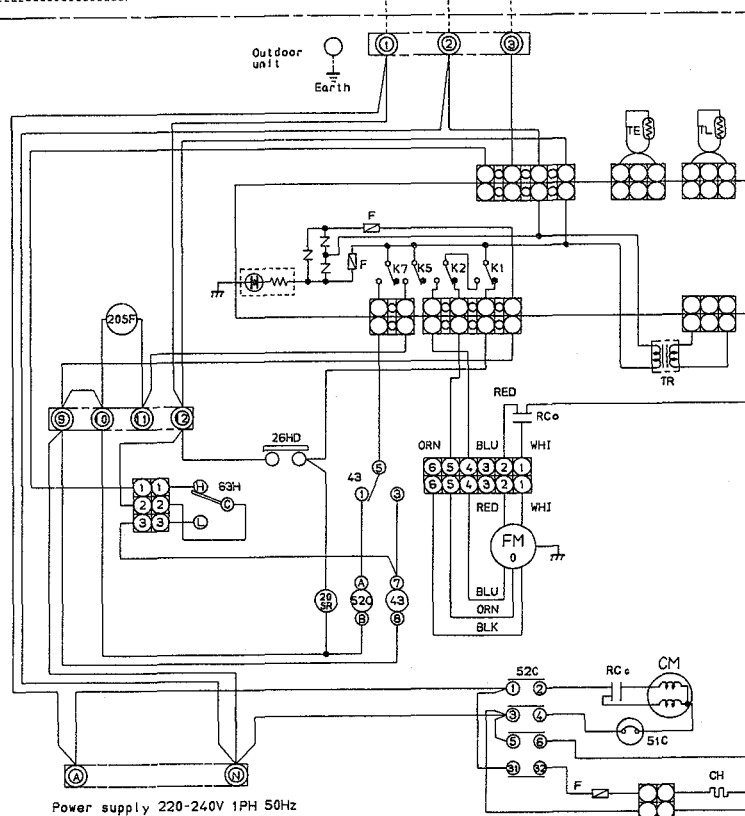
RAV-161BH/160AH-P



© shows terminal block and figures show terminal numbers.
Broken lines show wiring at site.

Don't operate the units with the magnetic contactor pushed.

Symbol	Name
20SR	Solenoid Coil (2-Way Valve)
K ₁ ~K ₇	Relay (Outdoor)
26HD	Bimetal Thermostat
51C	Overload Relay
RCc	Running Capacitor (Compressor)
20SF	Solenoid Coil (4-Way Valve)
CM	Compressor
52C	Magnetic Contactor
43	Relay
63H	High Pressure Switch
CH	Crankcase Heater
TR	Transformer
FMo	Fan Motor (Outdoor)
TL	Sensor
TE	Sensor
F	Fuse
RCo	Running Capacitor (Fan Motor)
FM	Fan Motor (Indoor)
RC	Running Capacitor
TA	Sensor
TC	Sensor
K ₁ ~K ₁₄	Relay (Indoor)



Power supply 220-240V 1PH 50Hz

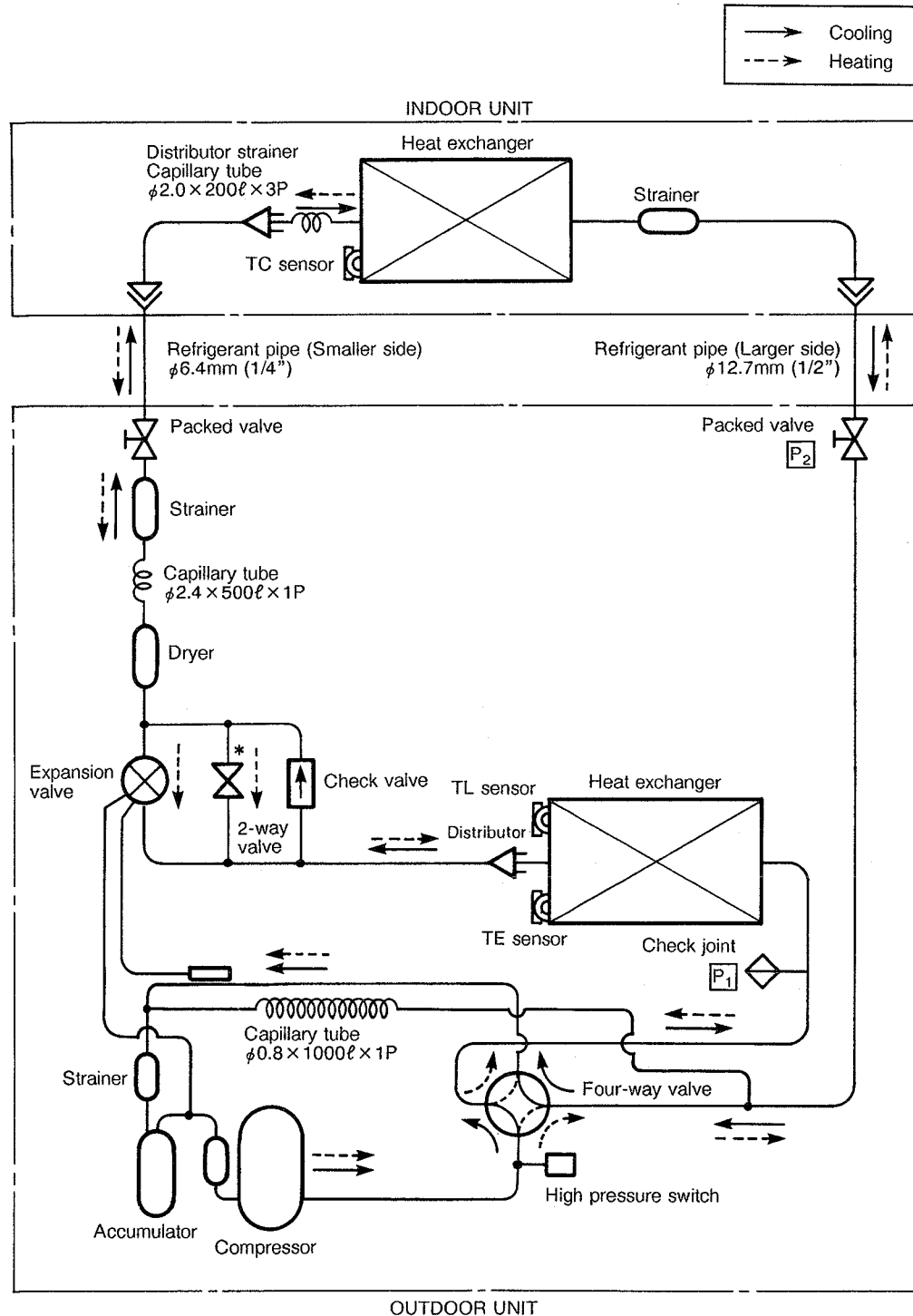
4. SPECIFICATIONS OF ELECTRICAL PARTS

4.1 RAV-161BH-P/160AH-P

NO.	PARTS NAME	TYPE	SPECIFICATIONS						
1	Indoor unit fan motor	STF-200-60-4A	Output (Rated) 60W, 4 pole, 1 phase, 200V, 50 Hz						
2	Running capacitor for indoor fan motor	EVM45M305UF	AC 450V, 3 μ F						
3	Transformer (Indoor unit)	FT-32-2	187~264V						
4	Sensor for room temperature		Maximum input 450 mW	°C	15	20	25	30	40
				k Ω	16.1	12.6	10.0	8.0	5.2
5	Indoor unit sensor for heat-exchanger temp.	DTN-C103J40	Maximum input 34 mA	°C	-12	0	25	50	
				k Ω	62.29	32.82	10.0	3.59	
6	Compressor	PH230X3-4LS	Output (Rated) 1.5 kW, 2 pole, 220/240V, 1 phase, 50 Hz						
7	Outdoor unit fan motor	SMF-230-39N	Output (Rated) 39W, 6 pole, 230V, 1 phase, 50 Hz						
8	Running capacitor for outdoor fan motor	EEP2G405HQA114	AC 400V, 4 μ F						
9	Magnetic contactor	FMca-1S	AC 230V, 2a1b						
10	High pressure switch	HTB-T317	Tripping pressure 30 kg/cm ² G Resetting pressure 23 kg/cm ² G						
11	Solenoid coil for four-way valve	LB60012	AC 230V, 50/60 Hz						
12	Crankcase heater		AC 240V, 28W						
13	Sensor for defrosting	DTN-C103J40	Maximum input 15.5 mA	°C	-12	0	25	10	
				k Ω	67.5	21.3			
14	Fuse		3A						
15	Sensor for cooling operation in low ambient temperature	DTN-C103J40	Maximum input 34 mA	°C	-12	0	25	50	
				k Ω	62.29	32.82	10.0	3.59	
16	Solenoid coil for two-way valve	NEV AC 240V	AC 220~240V, 50 Hz						
17	Relay	LY2F	AC 240V, 2ab						
18	Running capacitor for compressor	MT-44MP456W	AC 440V, 45 μ F						
19	Transformer (Outdoor unit)	FT28-2	187~264V						
20	Overload relay	OL-177GM15	AC 240V, Tripping temp: 165°C, Resetting temp: 80°C						
21	Bimetal thermostat	CS-7	Tripping temp: 110°C, Resetting temp: 90°C						

5. REFRIGERANT PIPING DIAGRAM

Indoor unit Outdoor unit
RAV-161BH-P RAV-160AH-P



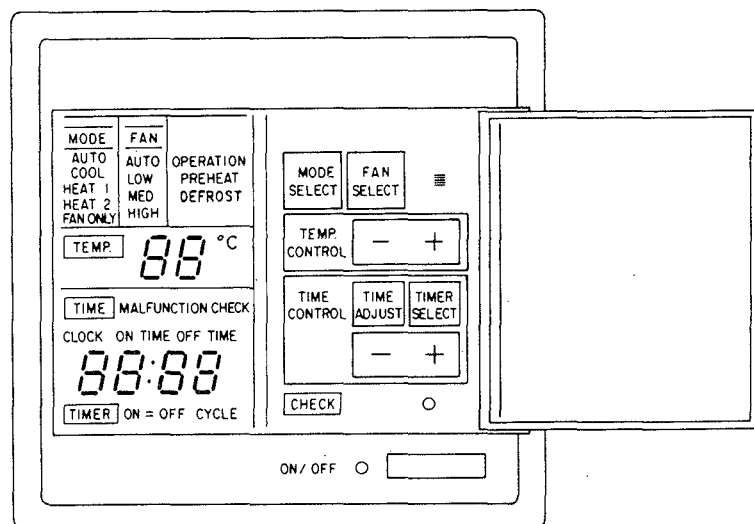
* Two-way valve will open when fan motor will go off on Cooling and Heating operation.

Line Pressure

	Cooling	Heating
P ₁	High pressure	Low pressure
P ₂	Low pressure	High pressure

6. REMOTE CONTROLLER

6.1 Remote controller



BUTTON	INDICATOR		OPERATION
ON/OFF		LED (RED)	Run/Stop
MODE SELECT	MODE	AUTO COOL HEAT 1 HEAT 2 FAN ONLY	Auto Changeover Cooling Heating Heating (with indoor fan operation at defrost) Fan only
FAN SELECT	FAN	AUTO LOW MED HIGH	Auto Fan Speed Control Low Fan Speed Med. Fan Speed High Fan Speed
TEMP. CONTROL	TEMP.	88 °C °F	Temperature setting
TIME ADJUST	TIME	(1) CLOCK (2) ON TIME (3) OFF TIME 88:88	(1) Present Time Adjust (2) ON Time Setting (3) OFF Time Setting
TIMER SELECT	TIMER	ON OFF ON → OFF ON ← OFF CYCLE	ON Timer OFF Timer ON → OFF Timer OFF → ON Timer 24H Cycle Timer

6.3 Timer operation

Continuous operation and timer operations are available. The setting of timer operation can be done as follows:
ON, OFF, ON → OFF, OFF → ON, ON ↔ OFF CYCLE.

6.3.1 Time display

The present time is always displayed

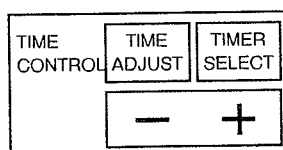
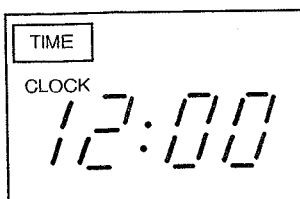
The display of the ON/OFF time is only in setting the time.

Once set, it will not changed even after carrying out the timer operation until the timer is reset.

Initial set time	The present time	12:00
	The time of ON	6:00
	The time of OFF	18:00

6.3.2 How to set the time

Liquid crystal



As to (-) and (+), change takes place by one minute by pressing once and 10 min./0.25 sec. by pressing continuously.

How to set the present time



[TIME ADJUST] switch is pressed.
[CLOCK] and Time figures flash.

- 2) Time is set by Time setting switch (-) or (+). The setting is finished when releasing. Pressing [TIME ADJUST] three times gives the display of the present time.
(If left as it is, after 15 sec. the display will go back to the present time).

How to set ON TIME



[TIME ADJUST] switch is pressed twice.
[ON TIME] and Time figures flash.

- 2) Time is set by Time setting switch (-) or (+). The setting is finished when releasing. Pressing [TIME ADJUST] twice gives the display of the present time.
(If left as it is, after 15 sec. the display will go back to the present time).

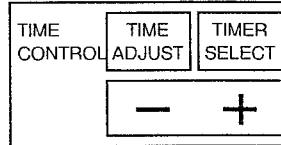
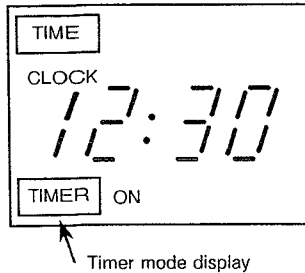
How to set OFF TIME



[TIME ADJUST] switch is pressed three times.
[OFF TIME] and Time figures flash.

- 2) Time is set by Time setting switch (-) or (+). The setting is finished when releasing. Pressing [TIME ADJUST] twice gives the display of the present time.
(If left as it is, after 15 sec. the display will go back to the present time).

6.3.3 How to set the timer operation



The following can be chosen sequentially by pressing [TIMER SELECT] switch:

- 1) [TIMER] ON
- 2) [TIMER] OFF
- 3) [TIMER] ON → OFF
- 4) [TIMER] ON ← OFF
- 5) [TIMER] CYCLE

* Be sure to set the present time.

* In case of reoperating after finishing timer operation, if [TIMER SELECT] is not altered, the timer operation will be performed again.

Timer ON operation

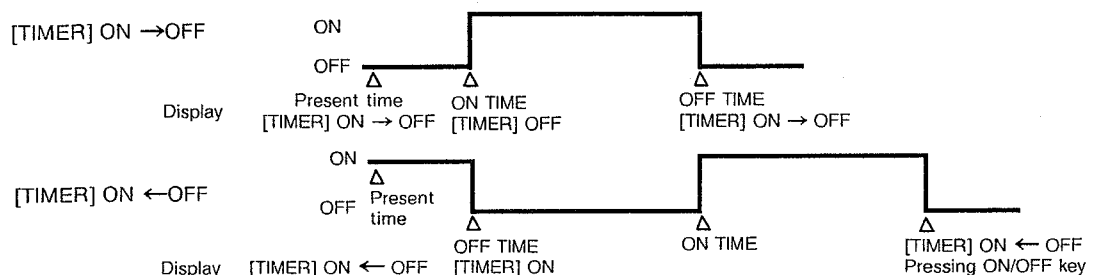
- 1) [TIMER] ON is applied.
- 2) ON/OFF key is pressed. Then LED is lighted.
When the set [ON TIME] comes, the operation starts and OPERATION display comes on the liquid crystal, and the [TIMER] ON display goes off.
- 3) LED and OPERATION display goes off upon pressing ON/OFF key for stopping and [TIMER] ON is displayed.

Timer OFF operation

- 1) [TIMER] OFF is applied.
- 2) ON/OFF key is pressed. Then LED is lighted and the operation starts with OPERATION displayed on the liquid crystal.
- 3) When the set [OFF TIME] comes, the operation stops and the LED, OPERATION display goes off with [TIMER] OFF displayed.

ON ↔ OFF timer operation

- 1) [TIMER] ON → OFF or [TIMER] ON ← OFF is applied.
- 2) ON/OFF key is pressed. LED comes on and the operation is performed as below:

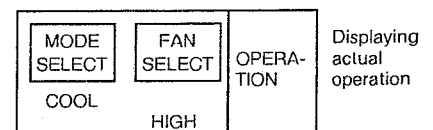


Repeated operation

- 1) [TIMER] CYCLE is applied.
- 2) ON/OFF key is pressed. Then LED is lighted and ON ↔ OFF timer operation is repeated according to the ON time and OFF time (repeating every day as it is a 24-hour timer).
- 3) The operation key is pressed. LED goes off and operation stops.

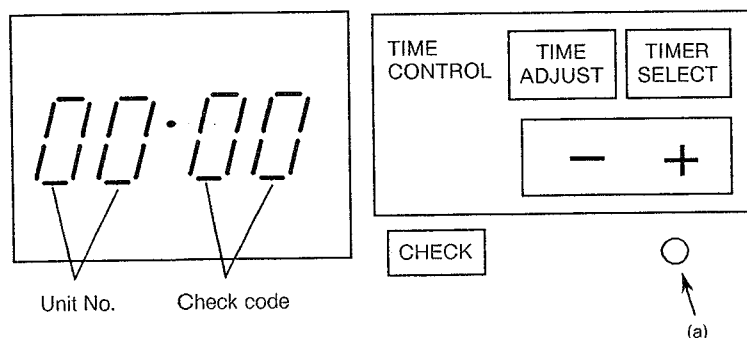
Timer stand-by display and operation display

Waiting on the timer is displayed by LED lighting while the actual operation is displayed on OPERATION on liquid crystal.



6.4 Malfunction check monitor

6.4.1 The times of thermostat ON as well as the check code are displayed on the time display area by pressing CHECK key.



[CHECK] switch

Provides check code display by pressing for one second and indoor microcomputer reset by pressing for 5 seconds.

- * Remote controller clear by pressing the key for 10 sec. Check code is cleared (normally not used).
- (a) Reset key (pushed by a needle and the like) Resetting remote controller (to the initial setting)

Judgement from operation status

	OPERATION STATUS	CODE	CAUSE
1.	Compressor stays off in cooling: it is not turned off in heating.	0C	Open-circuit in room temperature sensor.
	Compressor stays off in heating: it is not turned off in cooling.		Short-circuit in room temperature sensor.
2.	Indoor fan stays off in heating.	0d	Open-circuit in indoor heat-exchanger sensor.
	Outdoor fan continues ON-OFF operation in heating.		Short-circuit in indoor heat-exchanger sensor.
3.	Though indoor unit operates, outdoor unit remains off.	04	Abnormality in connecting cable between indoor and outdoor units.
4.	Indoor fan does not work in heating operation. Warm air comes out in cooling operation.	08	4-way valve coil burnt out, pipe clogged, abnormality in indoor heat-exchanger sensor.
5.	Indoor fan at LOW speed in cooling operation with the outdoor remaining in stoppage.	09	Refrigerant gas in shortage. Abnormality in indoor heat-exchanger sensor.
6.	Full stop	18	Open or short-circuit in outdoor TE sensor.
7.	Full stop	19	Open or short-circuit in outdoor TL sensor.
8.	Full stop	21	Pressure switch does not reset within the set time.
9.	Indoor unit does not operate at all.	99	Abnormality in connecting cable between remote controller and indoor units.
10. *	Though indoor unit operates, outdoor unit remains off.	0b	Abnormality in drain system. Fault of drain pump. Drain pipe clogged.

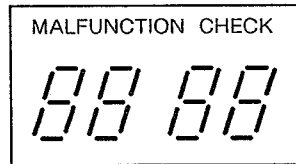
* With drain pump units only

Note: If the red LED on the remote controller does not flash when the system is switched on, then the wiring to the outdoor unit needs to be checked to ensure that the three phases are wired in the correct sequence. (RAV-260AH8 unit only.)

6.4.2 How to read malfunction check monitor display

By pressing [CHECK] key, times of No.1 unit compressor-ON actuations as well as the check code information of 2 faults × 16 units are displayed on the time display area. (2 sec. per one phenomenon)

< Times of compressor-ON >

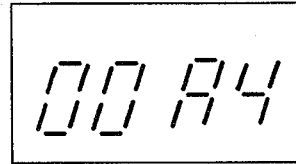


Display in 4 digits of hexadecimal notation

Display in 7 segments

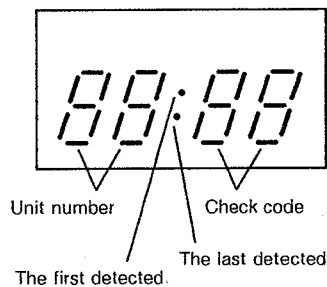


Ex. In case of the number of times of compressor actuations of 164.

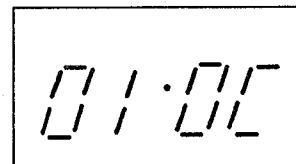


$$16^3 \times 0 + 16^2 \times 0 + 16 \times 10 + 4 = 164$$

< Check code information >

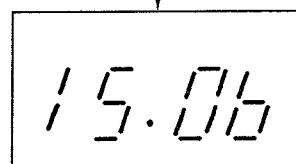
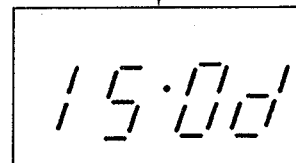
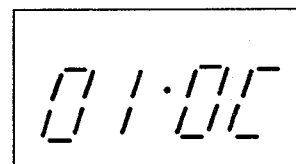


Ex. In case of room temperature sensor of No.1 unit in trouble.


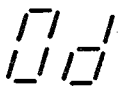
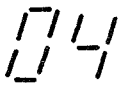

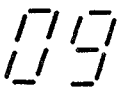
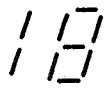



For No.15 unit, firstly heat exchanger temperature sensor and secondly float switch circuit are faulty.

No display is made if there is no fault.



6.4.3 List of Check Code

DIAGNOSTIC FUNCTIONS			JUDGEMENT AND ACTION
CHECK CODE	SYMPTOM	STATUS OF AIR CONDITIONER	
	<div>ROOM TEMP. SENSOR (TA).</div> <p>Out of place, break, short-circuit.</p>	Operation continuing	<ol style="list-style-type: none"> Check for indoor temp. sensor. Check for indoor PC board.
	<div>INDOOR HEAT-EXCHANGER SENSOR (TC).</div> <p>Out of place, break, short-circuit.</p>	Operation continuing	<ol style="list-style-type: none"> Check for indoor heat-exchanger sensor. Check for indoor PC board.
	<div>RETURN SIGNAL NOT COMING TO INDOOR</div> <ol style="list-style-type: none"> Wrong wiring in connecting cable (serial signal). 	Operation continuing	<ol style="list-style-type: none"> If outdoor unit does not work at all. <ol style="list-style-type: none"> Check for connecting cable correct wrong wiring. Check for outdoor PC board. If operates normally. <p>Between indoor terminal plates 2 and 3, return signal is :</p> <p>Available: Check for indoor PC board.</p> <p>Not available: Check for outdoor PC board.</p>
	<div>4-WAY VALVE SYSTEM</div> <ol style="list-style-type: none"> Indoor heat-exchanger temperature rises, after starting cooling operation. Indoor heat-exchanger temperature drops after starting heating operation. 	Operation continuing	<ol style="list-style-type: none"> Check for 4-way valve. Check for 2-way valve and check valve. Wrong with indoor heat exchanger sensor. Check for indoor PC board.
	<div>OTHER CYCLE SYSTEM</div> <ol style="list-style-type: none"> Indoor heat exchange temperature does not change after starting cooling/heating operation. When transmitting instruction for stopping compressor by freeze preventing control. 	Operation continuing	<ol style="list-style-type: none"> Compressor case thermostat, IOL, OL operation. (contactor OFF, compressor stops: AH8 Models) (contactor ON, compressor stops: AH Models) Indoor heat-exchange sensor out of place. Check for indoor PC board. Check that service valves are OPEN.
		Outdoor unit stops (indoor fan L)	<ol style="list-style-type: none"> Check for charged amount of refrigerant gas. (Gas shortage → gas supplement, check for gas leaks) Indoor fan locked.
	<div>DEFROST SENSOR (TE)</div> <p>Out of place, break, short-circuit.</p>	Full stop	<ol style="list-style-type: none"> Check for defrosting sensor. Check for outdoor PC board.

19	<div>OUTDOOR HEAT-EXCHANGER SENSOR (TL)</div> <p>Out of place, break, short-circuit.</p>	Full stop	<ol style="list-style-type: none"> 1. Check for outdoor heat-exchanger sensor. 2. Check for outdoor PC board.
21	<div>HIGH PRESSURE SWITCH</div> <p>High pressure switch does not reset. (5 sec : in cooling) (30 sec : in heating)</p>	Full stop	<ol style="list-style-type: none"> 1. Check for high pressure switch. 2. Check for outdoor PC board.
11	<div>OTHER ABNORMALITY OF OUTDOOR UNIT</div> <p>Compressor does not operate. Start once, but soon after stop by OCR.</p>	Full stop	<ol style="list-style-type: none"> 1. Check for compressor. 2. Check for wiring of compressor. (lack of phase, short circuit) 3. Check for voltage. 4. Check for outdoor PC board.
99	<div>WRONG WIRING OF REMOTE CONTROL UNIT</div> <p>Indoor unit does not operate at all.</p>	Full stop	<ol style="list-style-type: none"> 1. Check for wiring between remote control unit and indoor unit. 2. Check for indoor unit PC board.
	<div>FLOAT SWITCH</div> <p>Float circuit out of position, break.</p>	Outdoor unit stops	<ol style="list-style-type: none"> 1. Fault in drain pump. 2. Drain pipe clogged. 3. Check for indoor PC board.

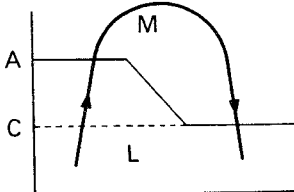
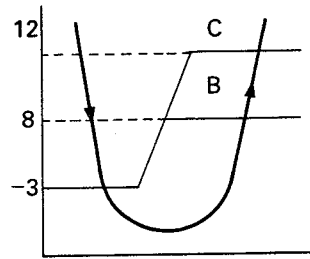
* With drain pump unit only.

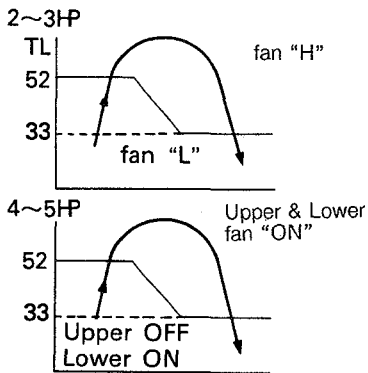
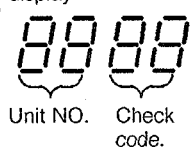
7. OUTLINE OF CONTROL CIRCUIT

NO.	ITEM	OUTLINE OF SPECIFICATIONS	REMARKS																		
1	Discrimination	Discrimination of outdoor unit is performed either in the reset of power source or when stopping from operating condition, and the controlling is changed over in accordance with the result of discrimination.																			
2	Operation change-over	<p>Operation mode is changed over according to operation mode select instruction from the remote controller.</p> <table><tr><th>REMOTE CONTROLLER INSTRUCTION</th><th>OUTLINE OF CONTROL</th></tr><tr><td>Stop</td><td>Stopping air conditioner</td></tr><tr><td>Auto</td><td>Performing automatic change-over</td></tr><tr><td>Cool</td><td>Performing cooling operation</td></tr><tr><td>Heat 1</td><td>Performing heating operation</td></tr><tr><td>Heat 2</td><td>Performing heating operation with indoor fan operation at defrosting</td></tr><tr><td>Fan only</td><td>Performing fan only operation</td></tr></table>	REMOTE CONTROLLER INSTRUCTION	OUTLINE OF CONTROL	Stop	Stopping air conditioner	Auto	Performing automatic change-over	Cool	Performing cooling operation	Heat 1	Performing heating operation	Heat 2	Performing heating operation with indoor fan operation at defrosting	Fan only	Performing fan only operation					
REMOTE CONTROLLER INSTRUCTION	OUTLINE OF CONTROL																				
Stop	Stopping air conditioner																				
Auto	Performing automatic change-over																				
Cool	Performing cooling operation																				
Heat 1	Performing heating operation																				
Heat 2	Performing heating operation with indoor fan operation at defrosting																				
Fan only	Performing fan only operation																				
3	Controlling room temperature	<p>3-1 Adjusting range (°C)</p> <table><tr><td></td><td>In cooling</td><td>In heating</td></tr><tr><td>Remote controller setting temperature</td><td>18 ~ 29</td><td>18 ~ 29</td></tr><tr><td>Operating temperature</td><td>18 ~ 29</td><td>20 ~ 31</td></tr></table> <p>3-2 Operating point is compressor - off. 3-3 Operating temperature accuracy: ±1°C. 3-4 Differential: 1 deg</p>		In cooling	In heating	Remote controller setting temperature	18 ~ 29	18 ~ 29	Operating temperature	18 ~ 29	20 ~ 31										
	In cooling	In heating																			
Remote controller setting temperature	18 ~ 29	18 ~ 29																			
Operating temperature	18 ~ 29	20 ~ 31																			
	Correcting temperature compensation	<p>3-5 Room temperature controlled in the heating operation can be corrected by dip switch of indoor microcomputer.</p> <table><tr><td>Dip switch</td><td>1</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr><tr><td>Setting</td><td>2</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td></tr><tr><td>Control temperature compensation</td><td></td><td>0deg</td><td>2deg</td><td>4deg</td><td>6deg</td></tr></table>	Dip switch	1	ON	ON	OFF	OFF	Setting	2	ON	OFF	ON	OFF	Control temperature compensation		0deg	2deg	4deg	6deg	
Dip switch	1	ON	ON	OFF	OFF																
Setting	2	ON	OFF	ON	OFF																
Control temperature compensation		0deg	2deg	4deg	6deg																

Ts(Max) = 35°C

NO.	ITEM	OUTLINE OF SPECIFICATIONS	REMARKS
4	Fan speed control	<p>4-1 [HIGH], [MED], [LOW] and [AUTO] are available.</p> <p>4-2 [Ultra low] or [Stop] when thermostat is turned off while heating is being performed.</p> <p>4-3 In the auto fan, the fan speed is changed by the difference between T_a and T_s, as shown below.</p> <div style="text-align: center;"> <p>- Cooling - - Heating - - Auto-changeover -</p> </div>	[Stop] is cold draft prevention by T_c .
5	Cold draft preventing control	<p>When performing heating operation, indoor fan control is carried out as follows based on temperature detection of T_c sensor.</p> <p>C zone: Depending upon fan speed setting of the remote controller</p> <p>B zone: Indoor fan at "L"</p> <p>A zone: Fan stop</p> <div style="text-align: center;"> </div>	
6	Freeze preventing control (Low temp. release)	<p>When performing cooling operation, the following control is done based on temperature detection of T_c sensor.</p> <ol style="list-style-type: none"> When starting the operation, the point P is made $+3^{\circ}\text{C}$. When [J] zone is detected, timer counting starts. When [K] zone is detected, timer counting is discontinued and held on. When [I] zone is detected, timer is cleared for returning back to ordinary operation. When timer counting becomes full time, the outdoor unit stops and the point P is changed to $+12^{\circ}\text{C}$ to be covered by check display. <p>When [I] zone is reached, the temperature is returned back to $+3^{\circ}\text{C}$.</p> <div style="text-align: center;"> </div>	<p>Full Time MIN 7 min. MAX 20 min.</p>

NO.	ITEM	OUTLINE OF SPECIFICATIONS	REMARKS																		
7	High temperature release control	<p>When performing heating operation, the following control is done based on temperature detection of Tc sensor.</p> <p>① In [M] zone, release signal is transmitted. Outdoor fan is turned off at the shortest for 3 minutes based on this signal.</p> <p>② The control point for A and C can be chosen from the below table:</p> <table><tr><td>Dip switch Setting</td><td>3</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr><tr><td></td><td>4</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td></tr><tr><td>A/C (°C)</td><td></td><td>54/52</td><td>58/56</td><td>60/58</td><td>-</td></tr></table> 	Dip switch Setting	3	ON	ON	OFF	OFF		4	ON	OFF	ON	OFF	A/C (°C)		54/52	58/56	60/58	-	<p>Interval operation of outdoor upper fan at low is done in the outdoor unit select B mode. (Outdoor fan)</p> <p>B = 4HP, 5HP</p>
Dip switch Setting	3	ON	ON	OFF	OFF																
	4	ON	OFF	ON	OFF																
A/C (°C)		54/52	58/56	60/58	-																
8	Residual heat removal	When stoppage takes place in [HEAT 2] operation, indoor fan is operated in [LOW] for 30' sec.																			
9	Test operation	<p>9-1 If Remote controller's ON/OFF switch is pressed 5 seconds continuously, the unit goes into test run mode with the indoor fan in the [HIGH].</p> <p>9-2 After continuing the operation for 30 minutes, [Fan only] operation is initiated.</p>																			
10	High pressure release	<p>The following control is performed when high pressure switch of the outdoor unit is actuated.</p> <p>① In cooling operation Compressor is turned off and if the high pressure switch does not reset for 5 seconds continuously thereafter, it is judged abnormal.</p> <p>② In heating operation Compressor is turned off and if the high pressure switch does not reset for 30 seconds continuously thereafter, it is judged abnormal. If the switch resets within 30 sec., the compressor restarts 2 minutes and 30 sec. later. And if this process is repeated, the release by outdoor fan and shift of compressor-on point will be done.</p> <p>③ In defrosting operation Compressor is turned off, the operation returning back to heating operation.</p>	<p>< Outdoor unit control > LED lamp comes on in abnormal condition, being abnormal code transmitted to indoor unit.</p>																		
11	Defrosting	<p>11-1 In heating operation, defrosting is made based on outdoor heat exchange temperature Te.</p> <p>11-2 When cumulative working time of the compressor in [A] zone has amounted to 55 minutes, defrosting operation starts. (25 minutes initially)</p> <p>11-3 The longest defrosting time is 12 minutes, 60 sec. in the case of turning into [B] zone, and immediate returning back when [C] zone is reached.</p> 	<p>< Outdoor unit control ></p>																		

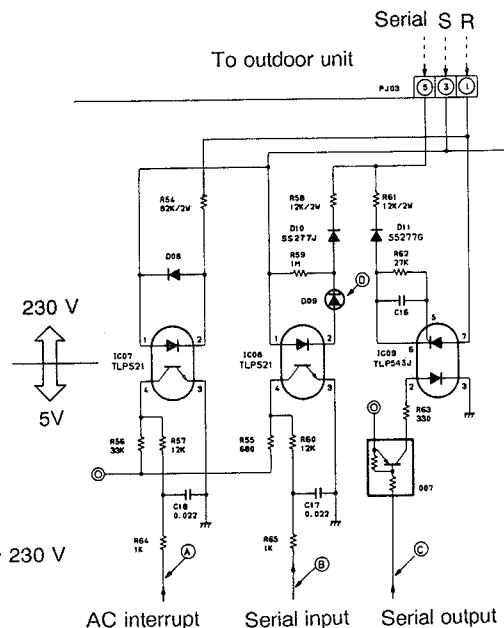
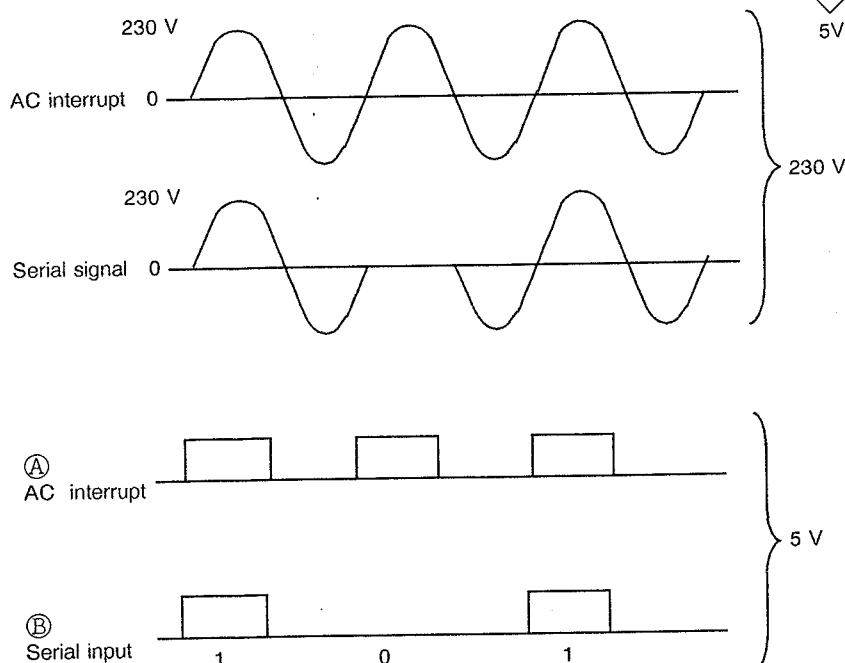
NO.	ITEM	OUTLINE OF SPECIFICATIONS	REMARKS
12	Low ambient cooling	<p>12-1 Control on outdoor fan is made to meet with cooling at low outdoor temperature based on outdoor heat exchange temperature TL.</p> <p>12-2 Control by outdoor heat exchange temperature TL is illustrated in the right.</p> 	< Outdoor unit control >
13	Check display	<p>Fault diagnosis is carried out by check for serial signal transmission and reception with outdoor unit as well as the self check by indoor microcomputer. And check code is transmitted to protective operation/remote controller based on the contents of it.</p> <p>In the remote controller, check code is displayed on the liquid crystal by pressing [CHECK] key.</p>	<p>See other item: Using [TIME] display</p> 
14	Anti-restart timer	The outdoor unit delays restarting for 2.5 min. to prevent short cycling compressor operation.	
15	Group operation control	<p>Up to 16 units can be controlled in same setting condition by one remote controller.</p> <p>However, thermo-control function is independent.</p> <p>Respective delayed start time for preventing simultaneous large starting current can be by different setting of the unit No. switch on the indoor PC board.</p>	Refer to P. 38.

8. DESCRIPTION OF INDOOR UNIT CONTROL CIRCUIT

8.1 Serial signal circuit (between outdoor and indoor units)

This is a circuit for transmitting and receiving the signals between the indoor and outdoor units in serial signal. As 230V is used for transmitting the signal, the microcomputer section is insulated by means of photo-coupler with the voltage reduced to 5V.

With AC interrupt, judgement is made as to the presence or absence of serial signal based on the reference pulse taken out from the voltage across R and S.

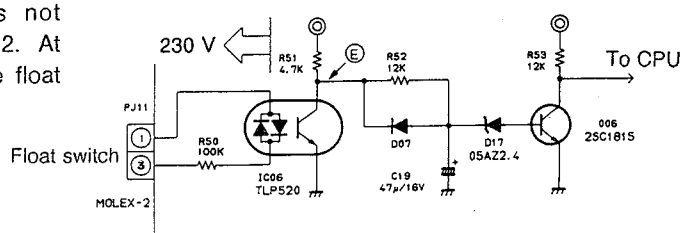


Ⓐ/Ⓑ are measurement points on the printed circuit board.

Ⓓ provides flashing (orange) on LED in the serial input.

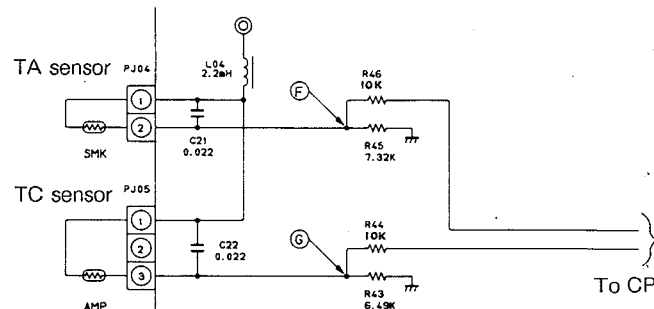
8.2 Float switch circuit

In normal condition in which float switch is not operated, 230V is applied across the pins 1 and 2. At this time, point Ⓔ is at the GND level. If the float switch is operated, Ⓔ will be at the level of 5V.



8.3 Sensor circuit

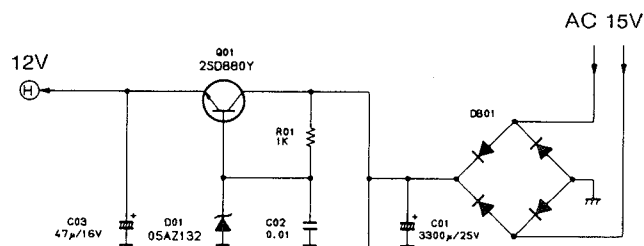
This circuit detects the temperature by dividing voltage with resistance and sensor and bringing the voltage value into CPU, using the characteristics of the sensor that resistance varies with different temperatures. TA and TC have the same circuit composition.



When TA and TC are at 25°C approximately, the voltage level is some 2V both at points ⑤ and ⑥. If ⑤ / ⑥ are at GND or 5V, abnormal condition prevails such as opening or short-circuit of the sensor.

8.4 12V power source circuit

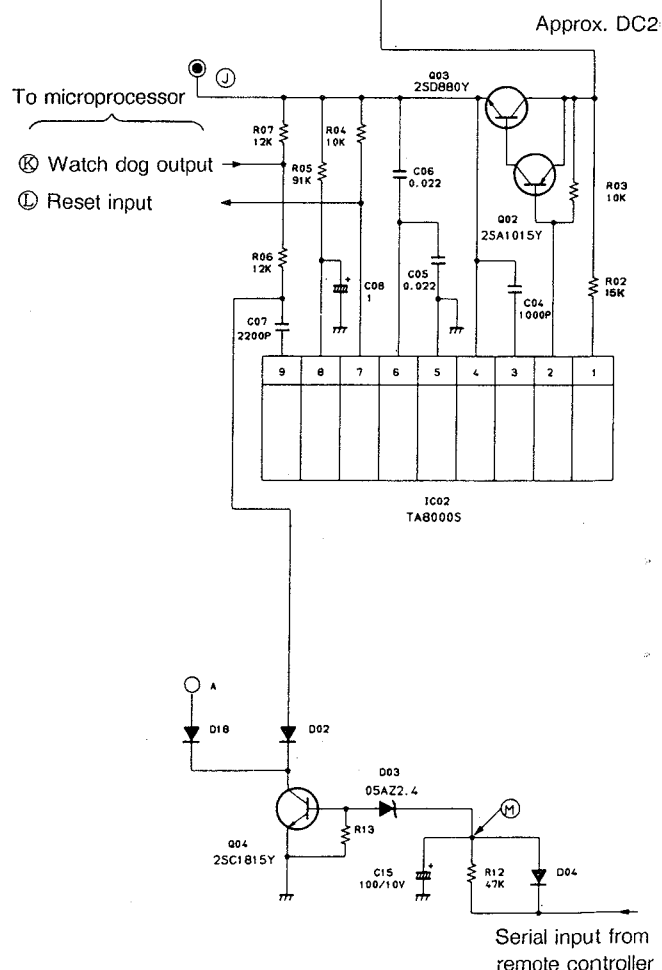
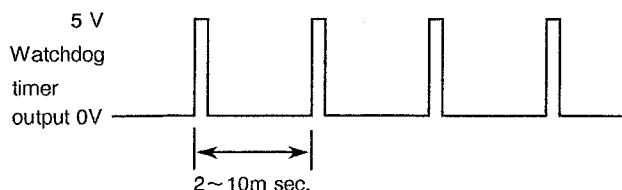
Full-wave rectification by diode bridge (DB01) of alternate current supplied from power transformer followed by the provision of transistor (Q01) gives DC12V power source (Ⓢ).



8.5 5V watchdog timer circuit

Built-in IC (TA8000S) is used to produce 5V power source (㉑). Also, it sends signals to reset port (㉒) of microcomputer which is in stand-by at 0V and starts its operation with the signal of 5V.

Watchdog timer output (Ⓚ) gives the signal from microcomputer as illustrated below. This indicates that the microcomputer is working in normal routine. For example if the microcomputer is straying due to noise and so on, this waveform is not produced. In case there is no waveform, it plays the role of restoring normal condition by inputting the resetting "0V" to the microcomputer.



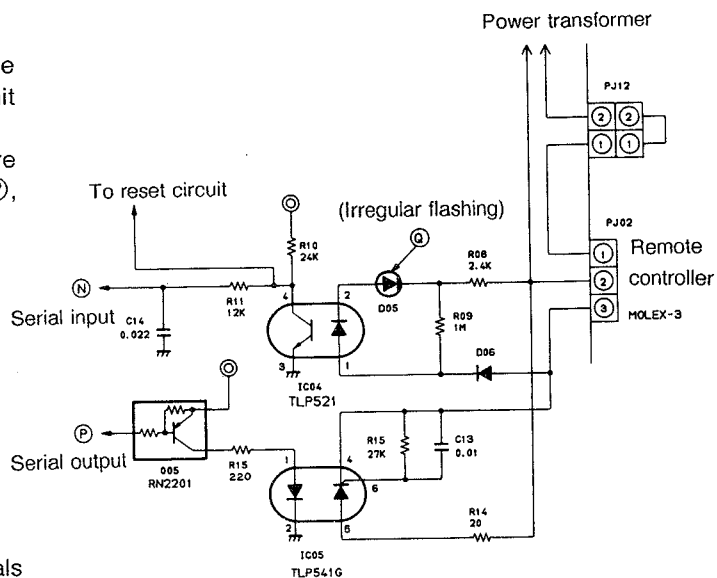
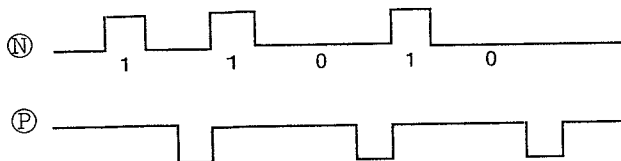
8.6 Reset circuit

This circuit makes indoor microcomputer reset by way of hardware when you keeps on pressing reset the check key of remote controller for longer than a predetermined period. It plays the role of resetting microcomputer from the remote controller when it strays. The point (Ⓜ), which is normally at the level of 5V, drops down to the GND level in the reset operation.

8.7 Serial signal circuit (Between remote controller and indoor unit)

This is the circuit for transmitting and receiving the signals between the remote controller and indoor unit in serial signal.

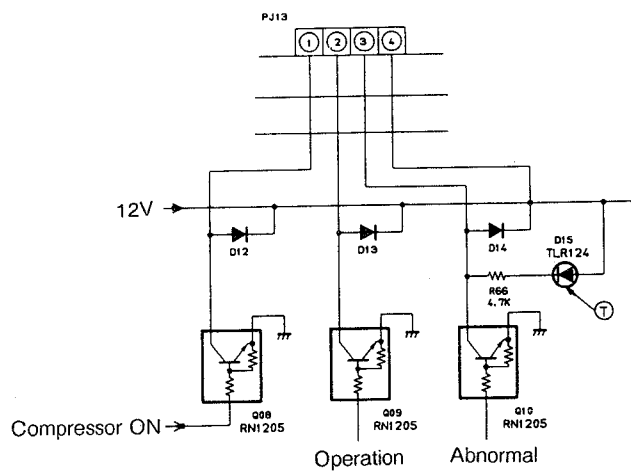
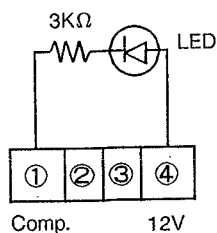
Point ④ is a LED (green) which flashes when there are signals from the remote controller. At ① and ②, the signals as illustrated below are output.



8.8 Optional circuit

A circuit which allows for the take-out of the signals of abnormal, operation and Compressor-ON. Point ① is a LED which lights at abnormal.

The connector pin 1 outputs 12V. When you want to see the signal of compressor-ON, you can do it simply with the circuit below.

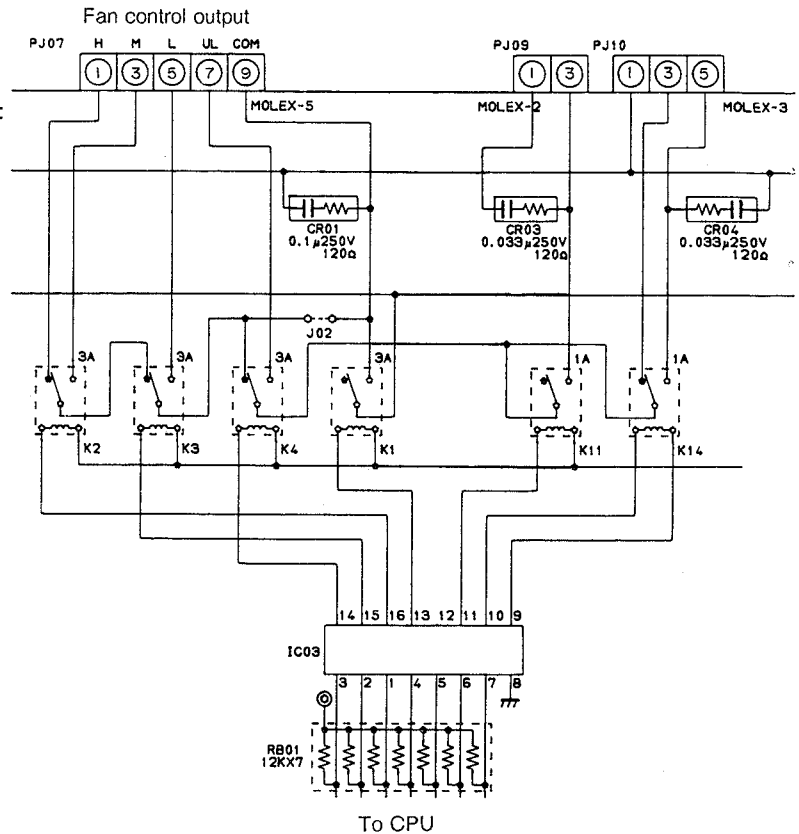


8.9 Relay circuit

The relay circuit consists of the diagram in the righthand side.

The relay performs the following functions:

- K1: Turning fan on and off
- K2: Changing over H/M of fan
- K3: L tap of fan
- K4: UL tap of fan
- K11: Turning louver on and off
- K14: Turning drain pump on and off
(① - ③)



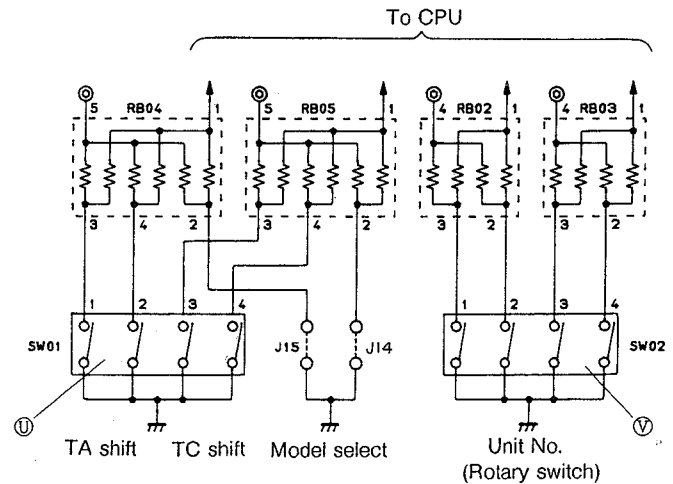
8.10 Switch circuit

TA shift, TC shift and unit No. are changed over by the switch.

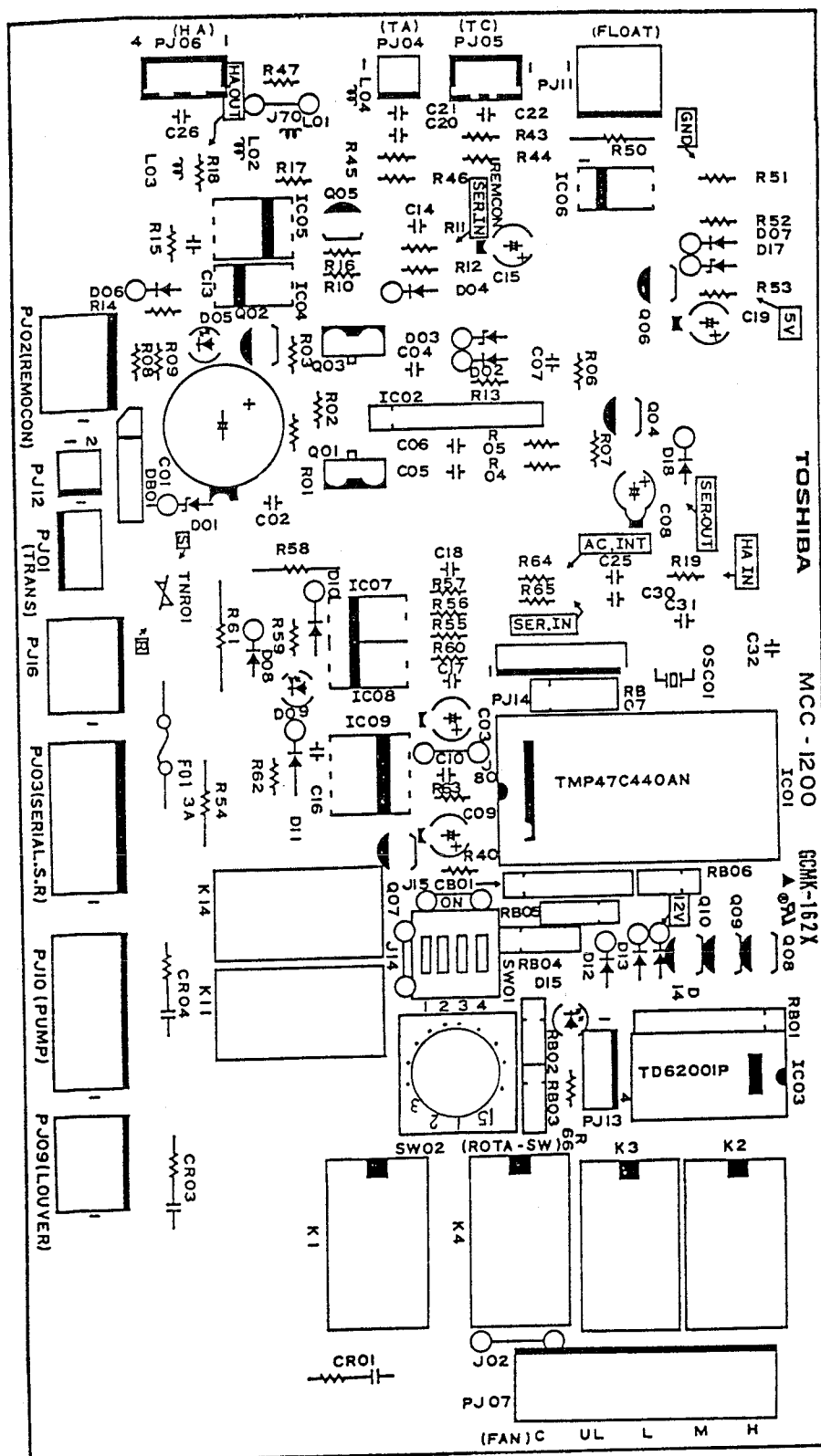
TA shift and TC shift are set in factory with unit No. at "1".

In servicing, the setting should be made to the same TA/TC shift as the PC board attached originally.

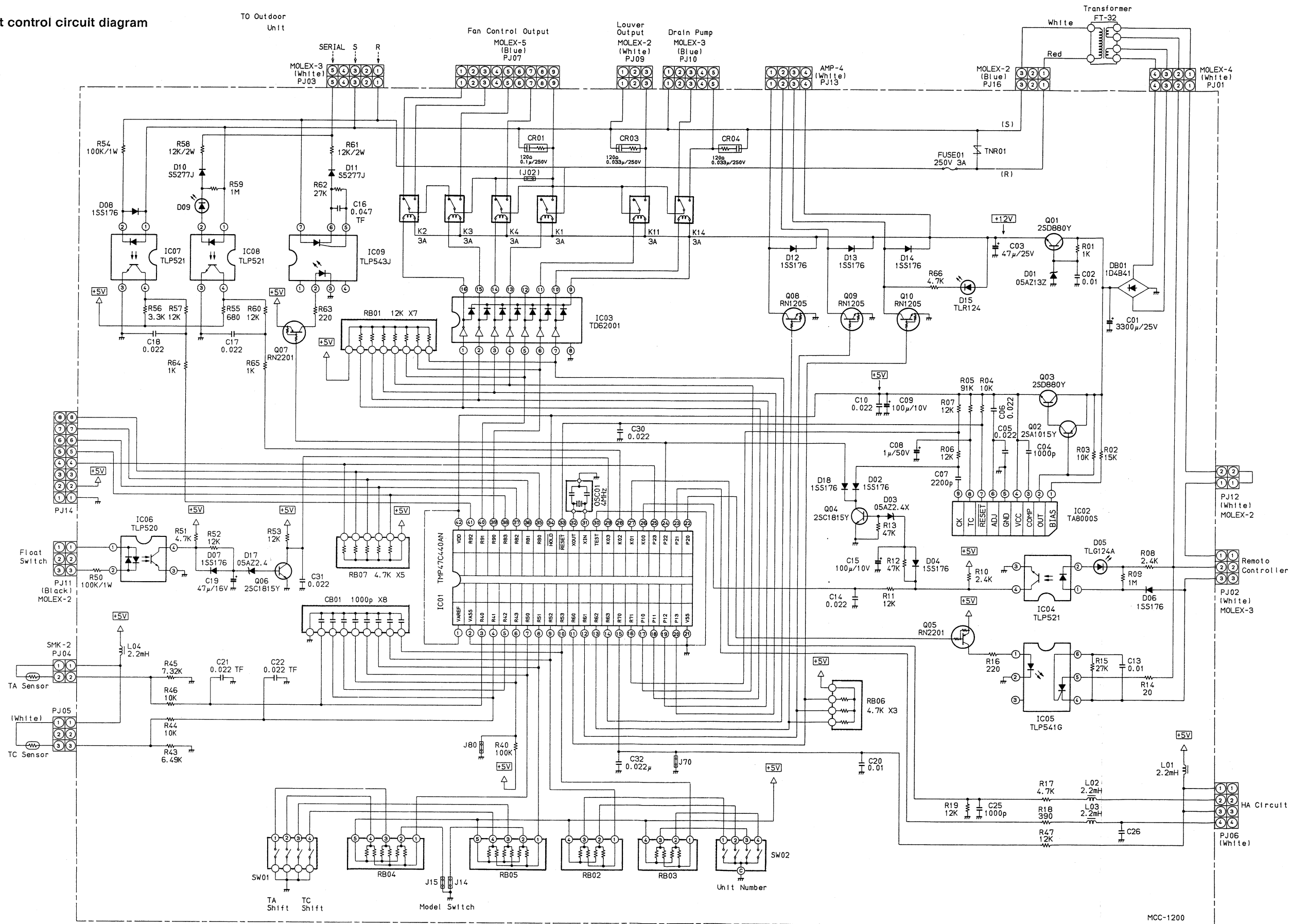
In case of operating one single unit, unit No. "1" will do. With the operation of many units (multi units control) the unit No. should be adjusted in such a way as 1, 2, 3



8.11 Indoor unit PC board

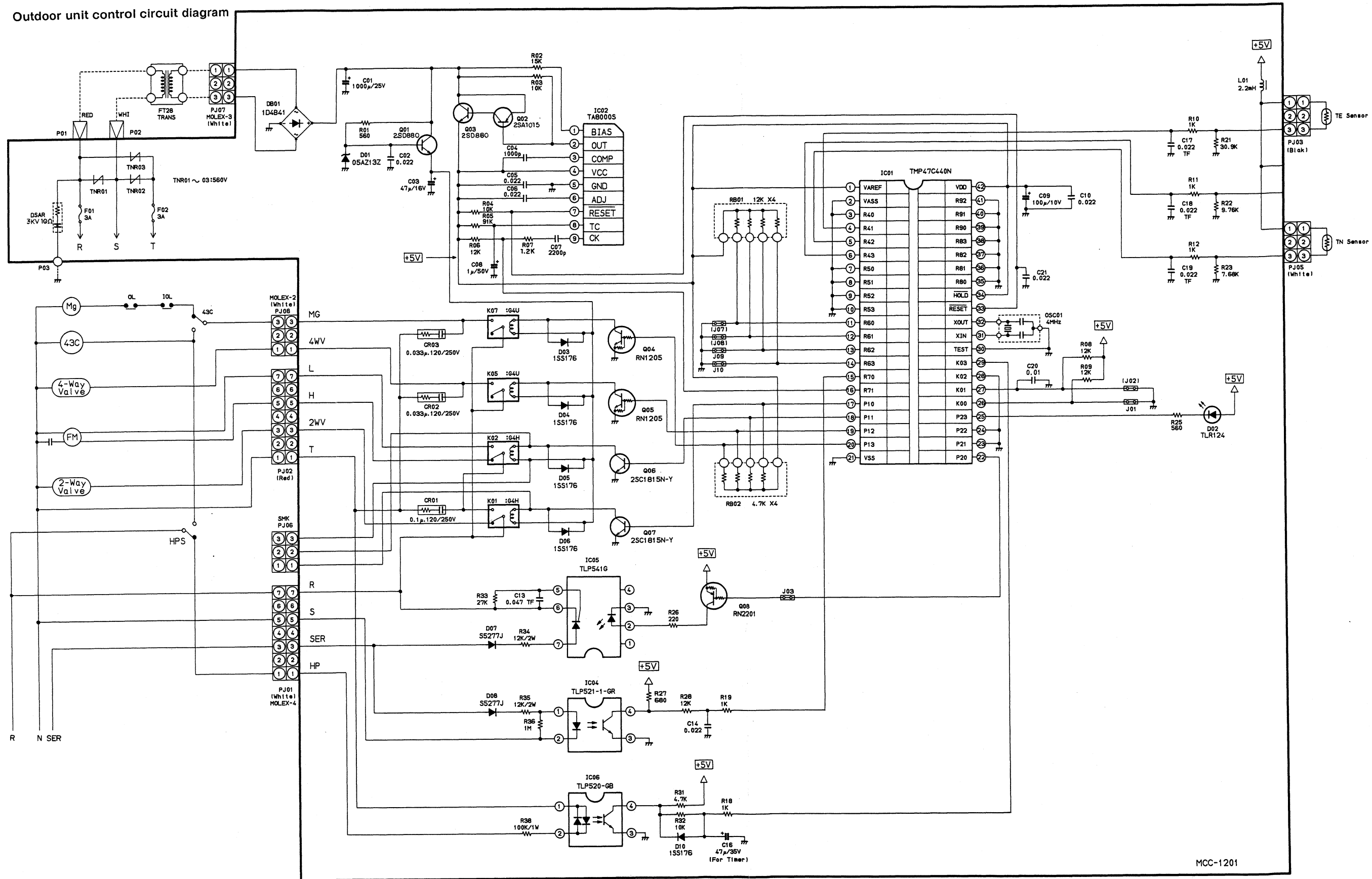


8.12 Indoor unit control circuit diagram



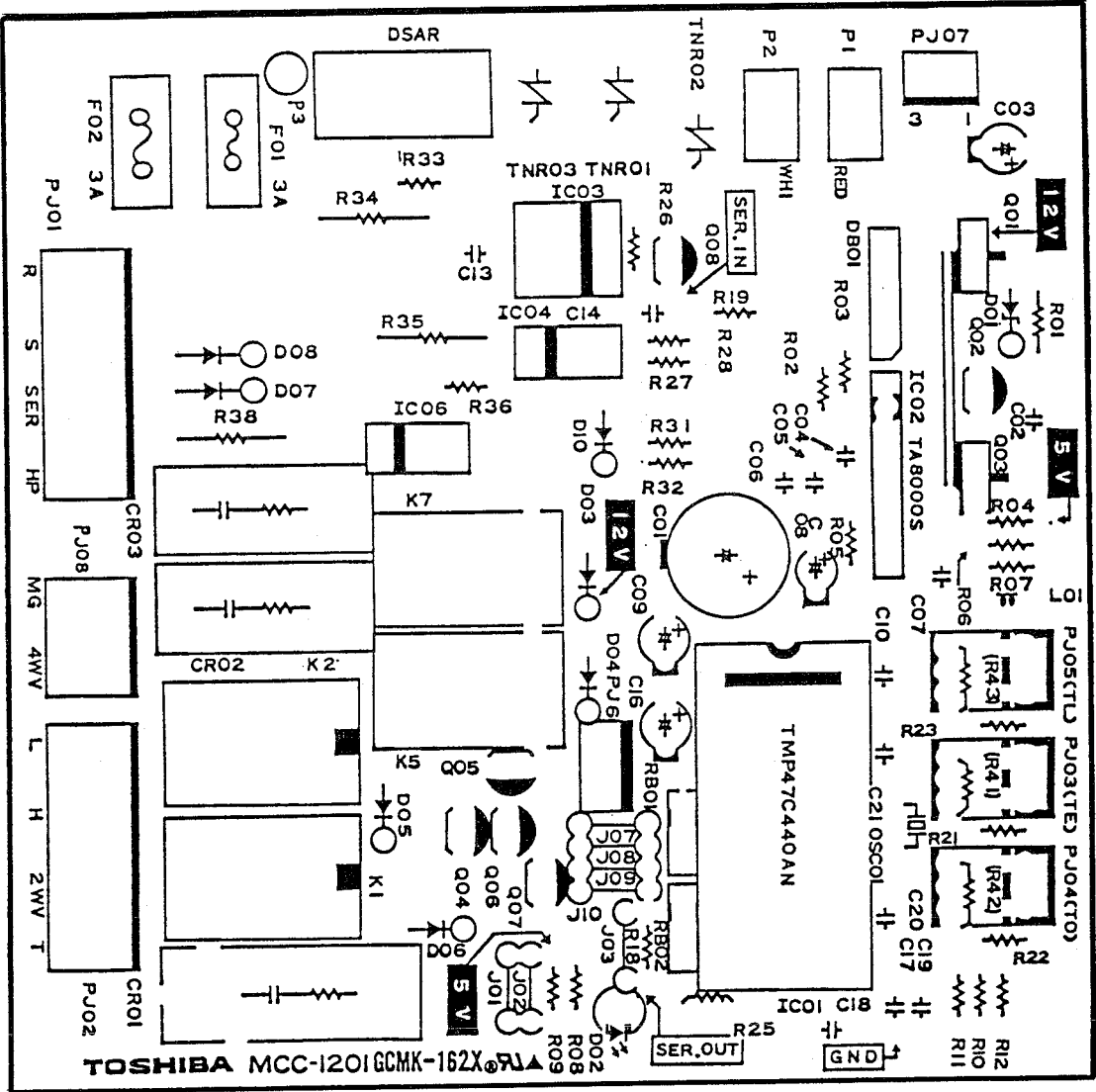
9. DESCRIPTION OF OUTDOOR UNIT CONTROL CIRCUIT

9.1 Outdoor unit control circuit diagram



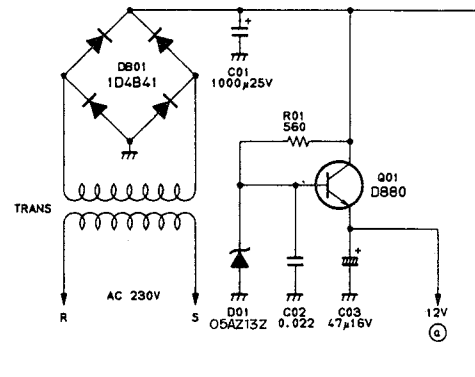
MCC-1201

9.2 Outdoor unit PC board



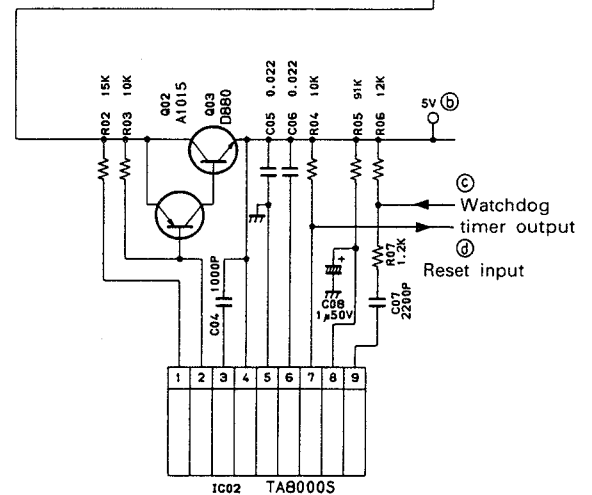
9.3 12V power source circuit

Outdoor PC board produces full-wave rectification by diode bridge (DB01) followed by the provision of transistor (Q01) produces DC power source (@) at 12V.



9.4 5V watchdog timer circuit

Basically, the same description as the indoor PC board applies, provided, however, that the reset circuit is not added to the outdoor side.



9.5 Sensor circuit

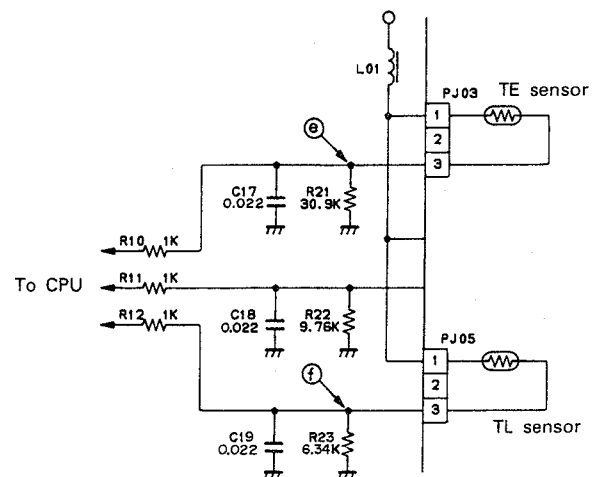
This circuit detects the temperature by dividing voltage with resistance and sensor and bringing the voltage value into CPU, using the characteristics of the sensor that resistance varies with different temperatures.

TE is for defrosting, while TL is for low ambient cooling operation.

The following voltages are produced at each of the temperatures.

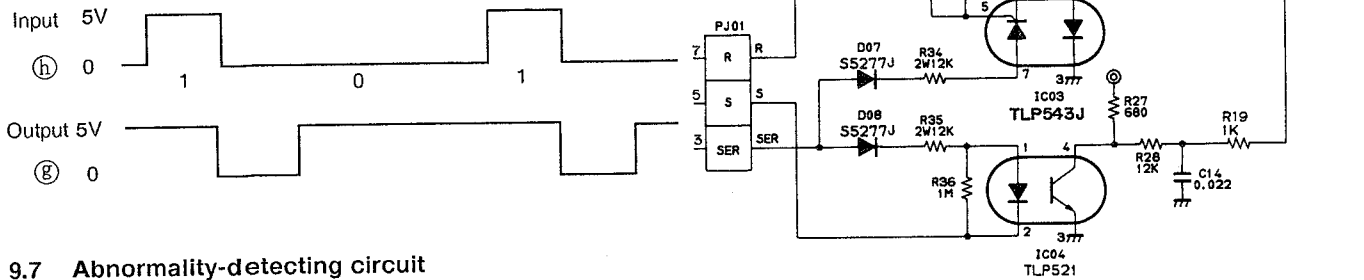
	0°C	25°C
TE (e)	2.3V	3.8V
TL (f)	0.8V	2.0V

When (e)/(f) are at GND or 5V, the sensors are either open or short-circuited.



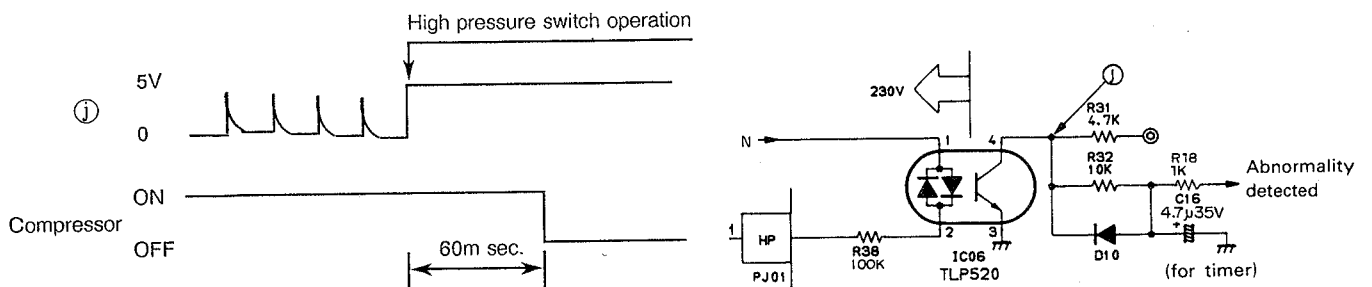
9.6 Serial signal circuit (between indoor and outdoor units)

Transmits and receives the signals between indoor and outdoor units in serial signals. As 230V is used for transmitting the signal, the microcomputer section is insulated with photo-coupler with 5V being supplied.



9.7 Abnormality-detecting circuit

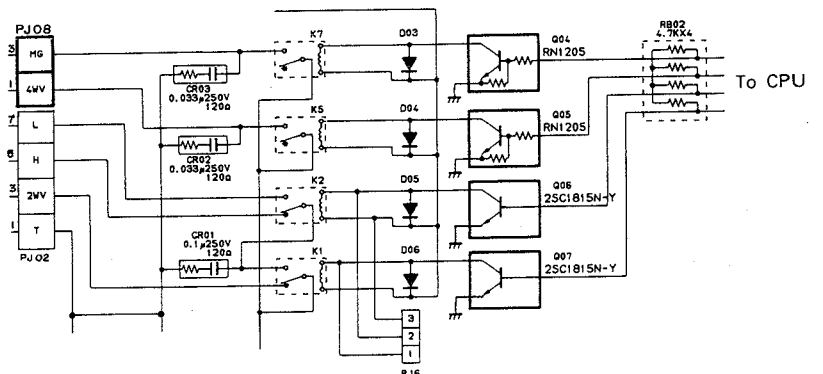
When high pressure switch is operated, abnormality is detected to stop the compressor.



9.8 Relay circuit

The relay circuit consists of the diagram in the righthand side.

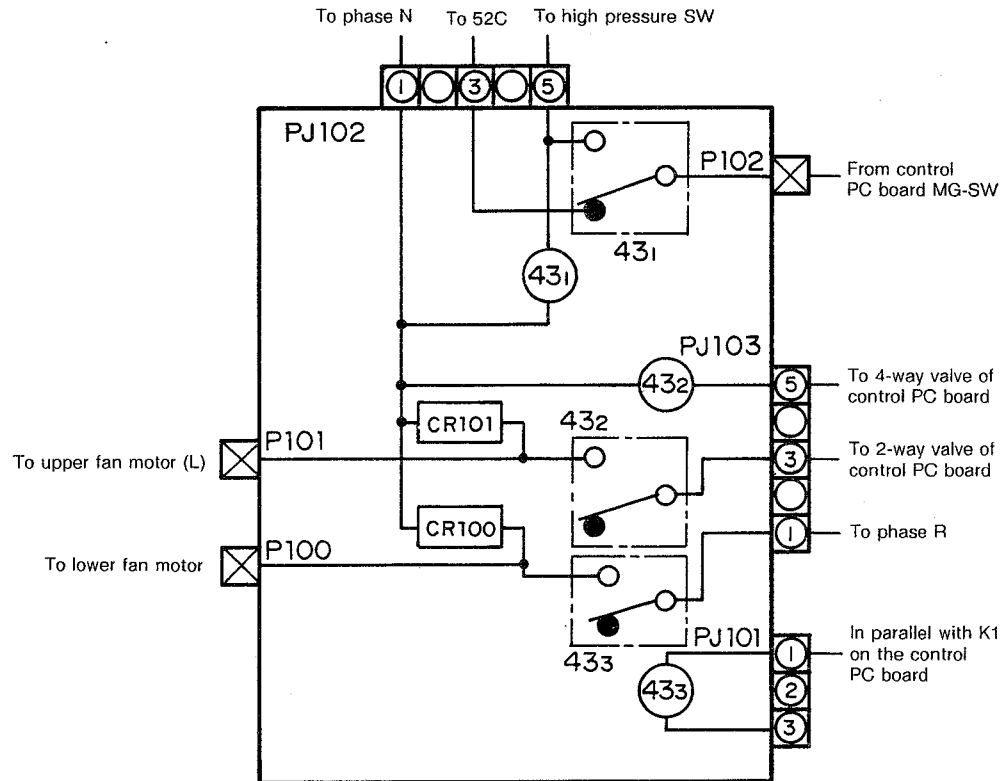
- K1: Turning fan on and off (2-way valve)
- K2: Changing over H/L of fan
- K5: Turning 4-way valve on and off
- K7: Turning compressor on and off



10. OPERATION OF RELAY PC BOARD (MCC-1231)

10.1 Purpose: Outdoor fan motor control and absorption of power source surging

10.2 Circuit



10.3 Operation

		K1 OUTPUT	MG SW OUTPUT	4-WAY VALVE OUTPUT	2-WAY VALVE OUTPUT	HIGH PRESSURE SW		FAN MOTOR		
		Relay 43 ₃	Relay K ₇	Relay 43 ₂		63H	Relay 43 ₁	Upper (H)	Upper (L)	Lower
Cooling	Normal operation		○	○	×	×	×	○	×	○
	High pressure switch operation	normal		×	×	×	○	×	×	×
		K ₇ abnormal		×	○	○	○	×	×	×
	Low ambient operation		○	○	×	×	×	×	×	○
Heating	Normal operation		○	○	○	×	×	×	○	○
	In the release		×	○	○	Through contact 43 ₂	×	×	×	○

11. EMERGENCY OPERATION (COOLING OPERATION ONLY)

By way of temporary expedient, change-over connectors are incorporated which allow for application of 240V directly to indoor fan motor, outdoor fan motor and magnet switch. In this case, operation and stop is effected by ON/OFF of the power line. (The emergency operation is not provided for heating as it can be substituted by other heating appliances and also because of nonavailability of defrosting approach).

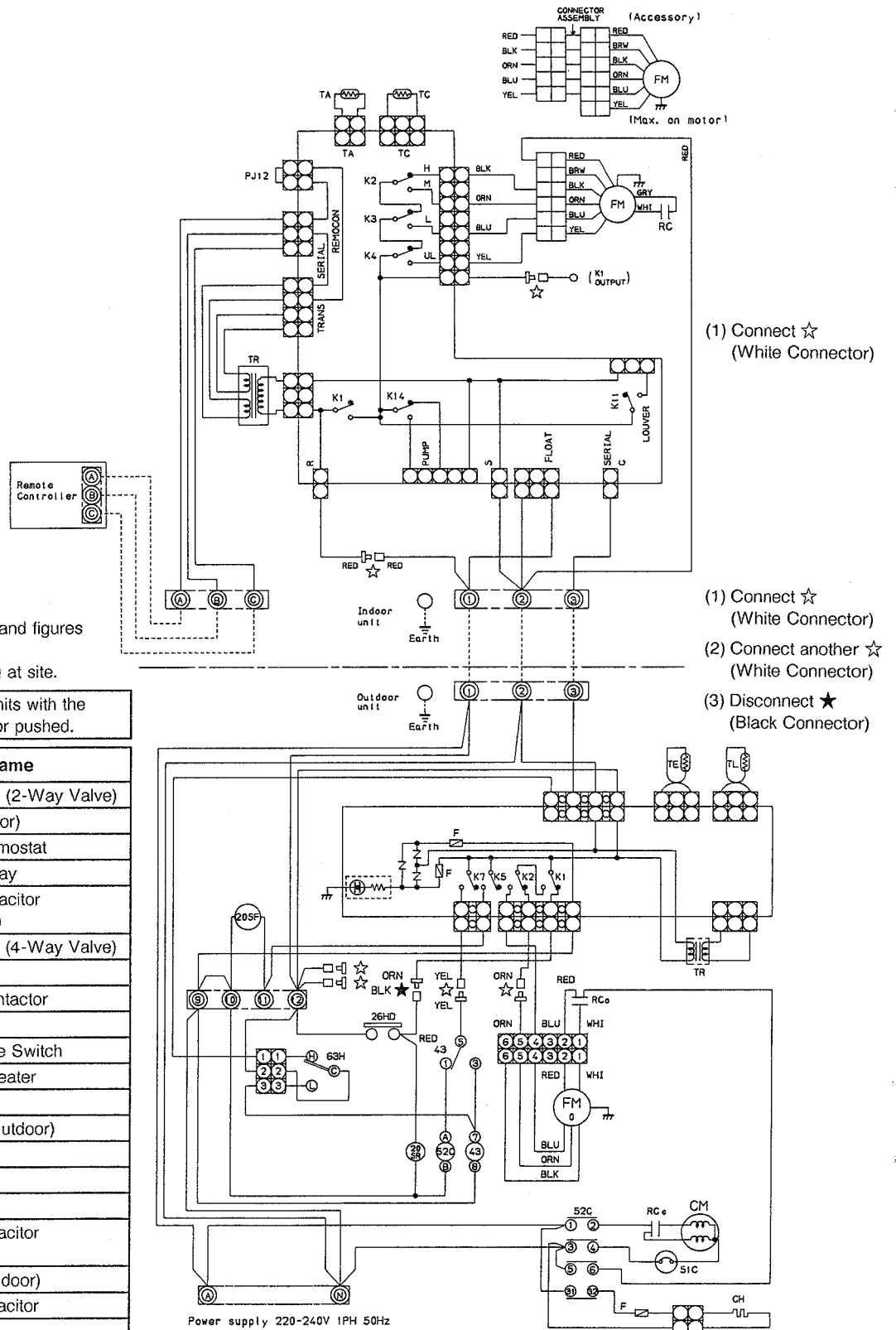
Counter-measures	Indoor connector	Pull out the connector of R phase (red) lead wire from terminal ① and connect it with the connector of lead wire for fan motor K1 output (red).
	Outdoor connector	(1) Disconnect white 1P connector on fan motor wire harness and connect to a red lead from terminal ⑫. (2) Disconnect white 1P connector on yellow lead from Omron relay (43), and connect to another red lead from terminal ⑫. (3) Disconnect black 1P connector between orange lead from PC Board and red lead from Bimetal Thermostat (26HD).
Operation	Operation and stop by the power switch at hand. (High pressure switch becomes the only protective circuit.)	

For the method, refer to next page.

© shows terminal block and figures show terminal numbers.
Broken lines show wiring at site.

Don't operate the units with the magnetic contactor pushed.

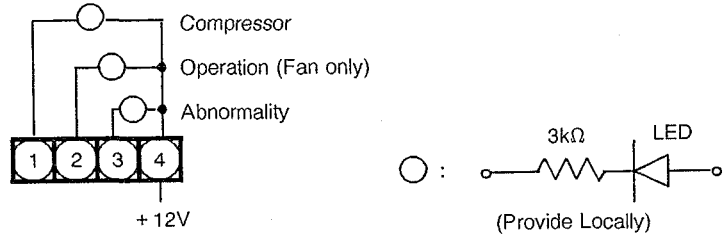
Symbol	Name
20SR	Solenoid Coil (2-Way Valve)
K ₁ ~K ₇	Relay (Outdoor)
26HD	Bimetal Thermostat
51C	Overload Relay
RCc	Running Capacitor (Compressor)
20SF	Solenoid Coil (4-Way Valve)
CM	Compressor
52C	Magnetic Contactor
43	Relay
63H	High Pressure Switch
CH	Crankcase Heater
TR	Transformer
FMo	Fan Motor (Outdoor)
TL	Sensor
TE	Sensor
F	Fuse
RCo	Running Capacitor (Fan Motor)
FM	Fan Motor (Indoor)
RC	Running Capacitor
TA	Sensor
TC	Sensor
K ₁ ~K ₁₄	Relay (Indoor)



12. APPLIED CIRCUIT

(1) Display output (PJ13)

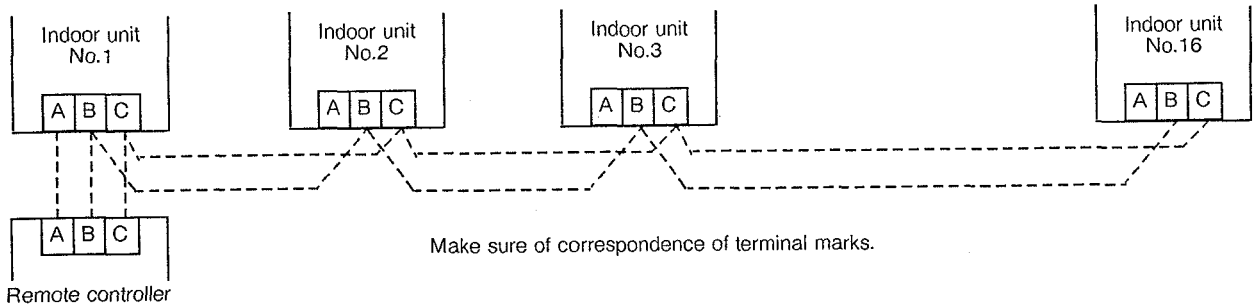
An auxiliary display output circuit (+12V) is available at PJ13 on the Indoor PC Board to display the operation for compressor, operation (Fan only) and abnormality.



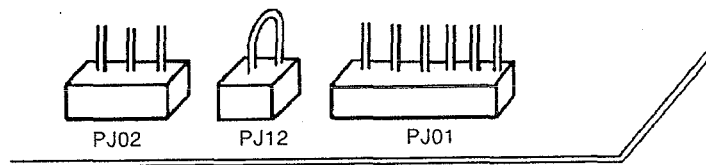
13. WIRING FOR GROUP OPERATION

Up to 16 units can be controlled as a group by one remote controller.

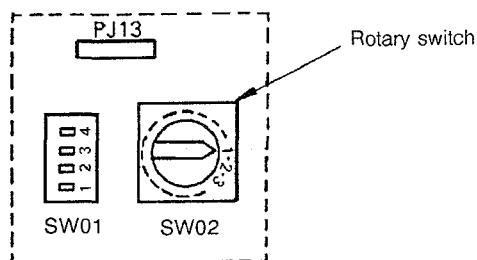
- ① Align the phase sequence of the power supply to all outdoor units.
- ② Connect the terminals A, B, C on both of the remote controller and the indoor unit of No.1 unit.
- ③ Connect terminals B, C on both indoor units of No.1 and No.2 unit. Then connect in the same way No.2 and No.3, No.3 and No.4 up to No.16 unit.



- ④ Remove the PJ12-connector on the indoor PC board of No.2 unit and up to No.16 unit to prevent malfunction.

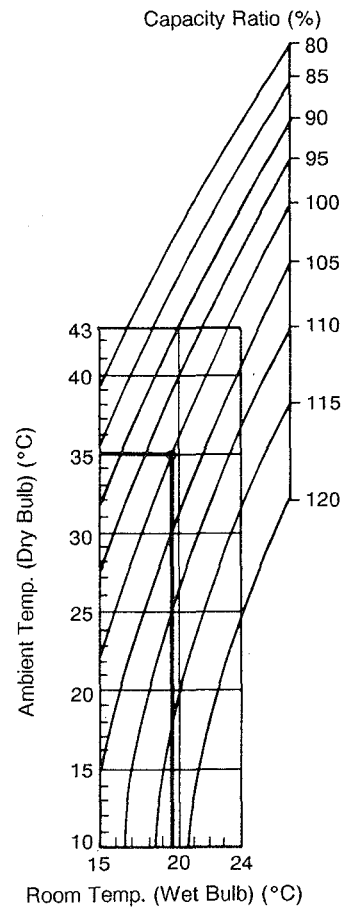


- ⑤ Set each unit No. rotary switch on the indoor PC board. The unit connected to the remote controller should be set as No.1 unit. Then set No.2 and up to No.16 so that start time of each unit is respectively delayed to prevent simultaneous starting current.

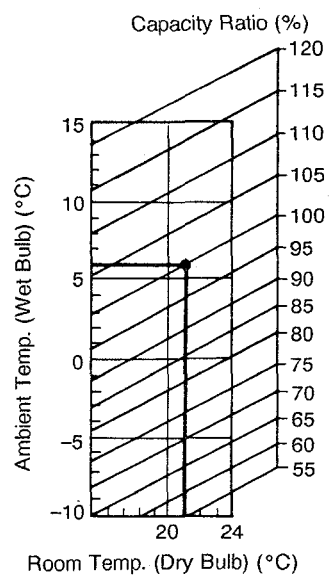


14. PERFORMANCE CHARACTER

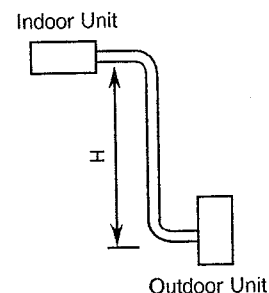
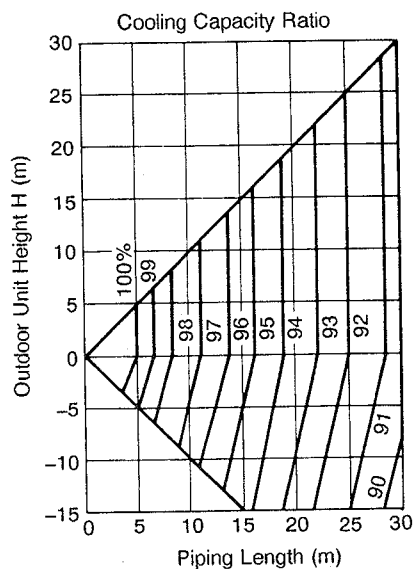
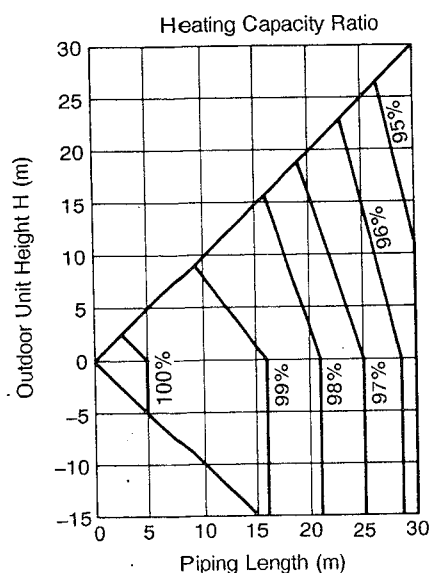
14.1 Cooling capacity



14.2 Heating capacity



14.3 Piping length/cooling capacity/heating capacity

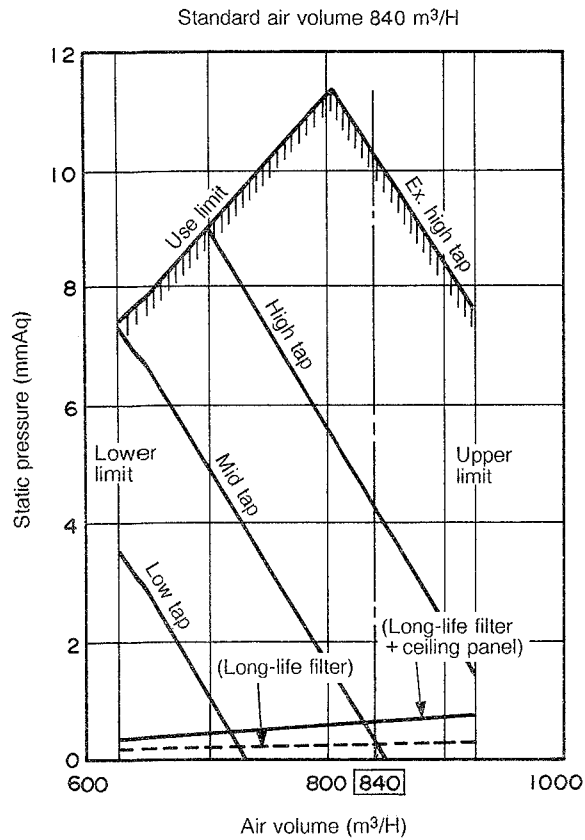


14.4 Piping length/additional refrigerant volume

Model \ Piping length less than (m)	20	Additional amount of refrigerant at installation site (kg)						Recharge amount of interchange time (kg)									
		25	30	35	40	45	50	5	10	15	20	25	30	35	40	45	50
RAV-161BH-P	Filled at factory	0.15	0.35					1.35	1.45	1.5	1.6	1.75	1.95				

- The amount of refrigerant put into the outdoor unit at the factory is equivalent to the one that fills up 20m length of refrigerant pipe.
- If the length of refrigerant pipe is 20m or less, addition of refrigerant at the installation site is unnecessary. If the length of the pipe exceeds 20m, add the refrigerant R-22.
- Overcharge or undercharge of refrigerant in the outdoor unit will cause malfunction of the compressor. The prescribed amount of the replenishment of the refrigerant is shown in the table above.
The permissible amount of refrigerant is the prescribed amount $\pm 50g$.

14.5 Blower performance

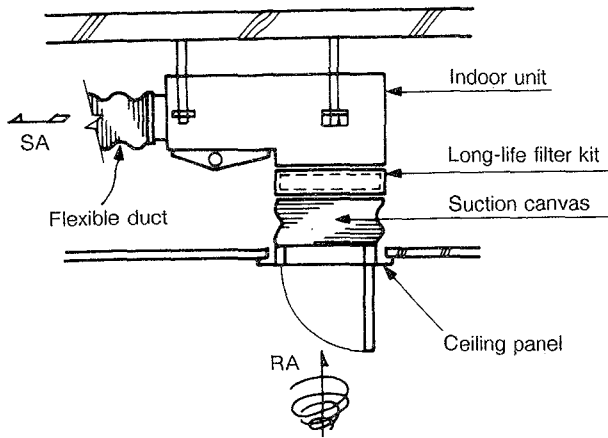


Fan motor tap-changing

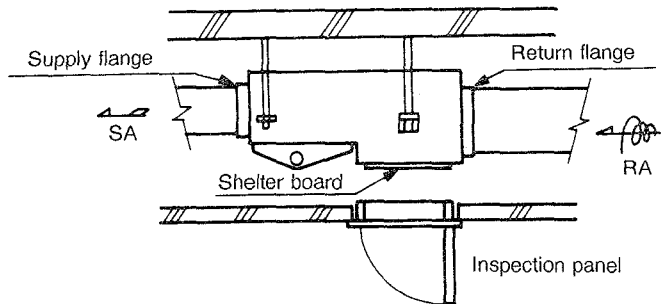
- To increase the static pressure of the fan tap-changing is required.
- Connect the connector assembly (attachment) between the fan motor and its wiring in the electrical parts box.

15. SAMPLES OF INSTALLATION COMBINED WITH OPTIONAL PARTS

(1) Bottom suction method



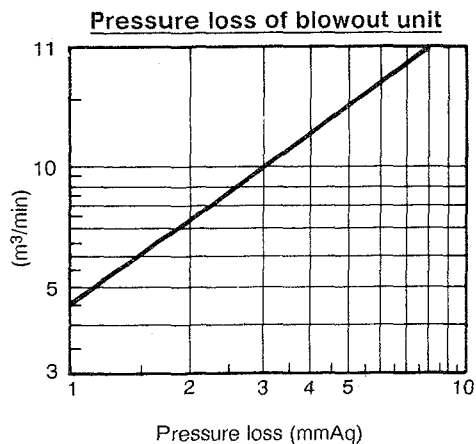
(2) Suction duct connection method



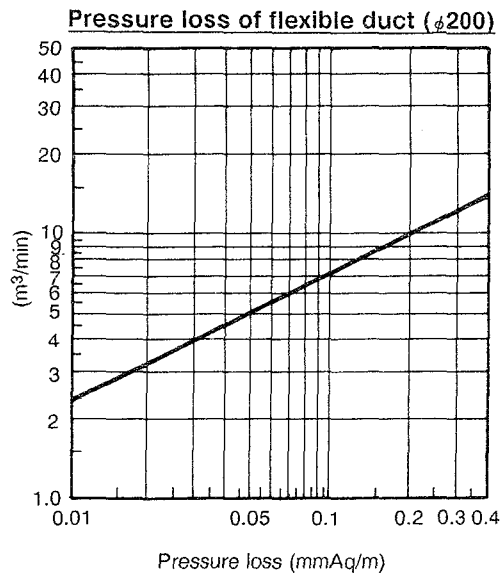
Installation method	Model	RAV-161BH-P
Bottom suction method	Combined optional parts	
	Ceiling panel	RBC-B161PE(W)
	Suction canvas	RBC-CA161BE
	Long-life filter kit	RBC-LK161BE
	*Flexible duct	RBC-FD202E (length: 2m)
Suction duct method	Blowout unit	RBC-BU1E(W)
	Shelter board	Refer to site production page 44.
	Supply flange	Refer to site production page 43.
	Return flange	Refer to site production page 43.

* Maximum length of the flexible duct is up to 10 m.

Pressure loss of optional parts
Model: RBC-BU1E(W)



Model: RBC-FD202E



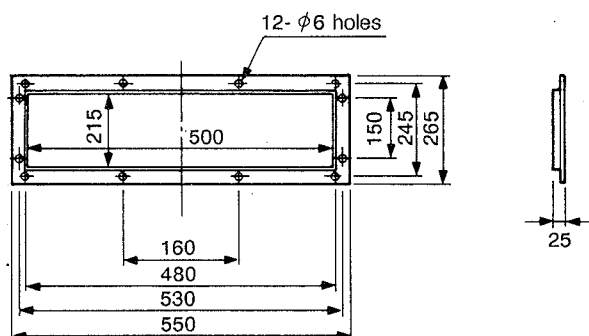
16. CONNECTION FLANGE (REFERENCE)

- **Connection Flange of Air Outlet and Inlet Ducting**

Connection flange is not provided on the indoor unit. Procure it as shown below at site.

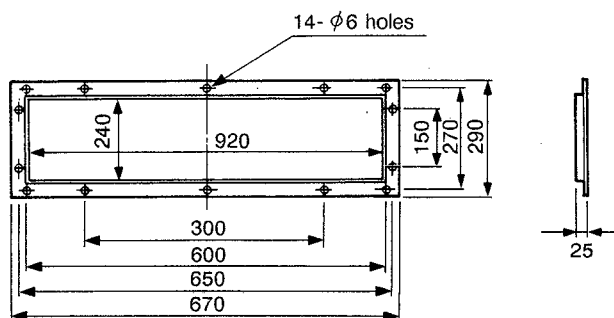
RAV-161BH-P

SUPPLY FLANGE



RAV-161BH-P

RETURN FLANGE

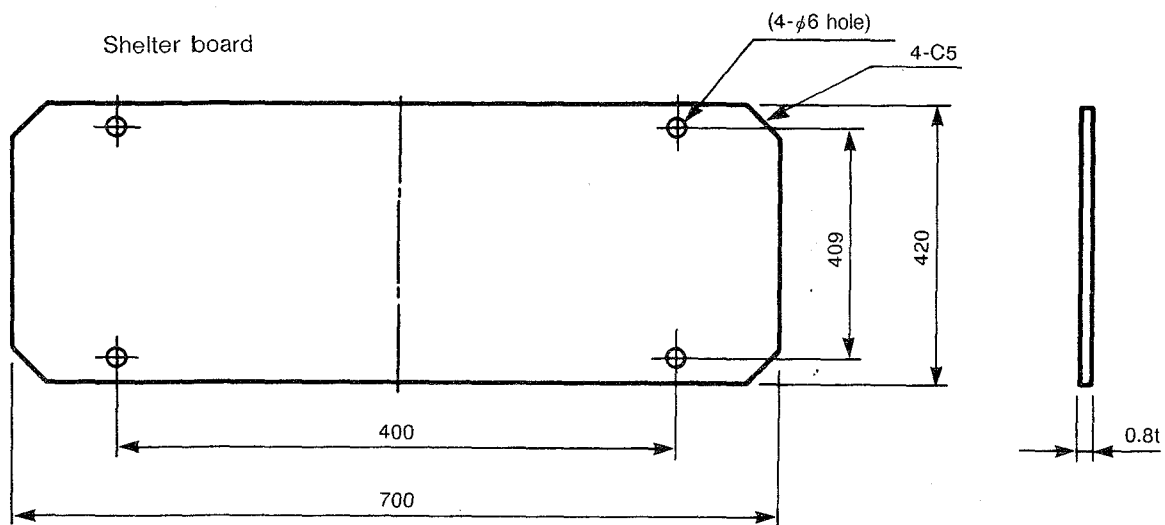


17. SHELTER BOARD

- **Shelter Board of Air Inlet**

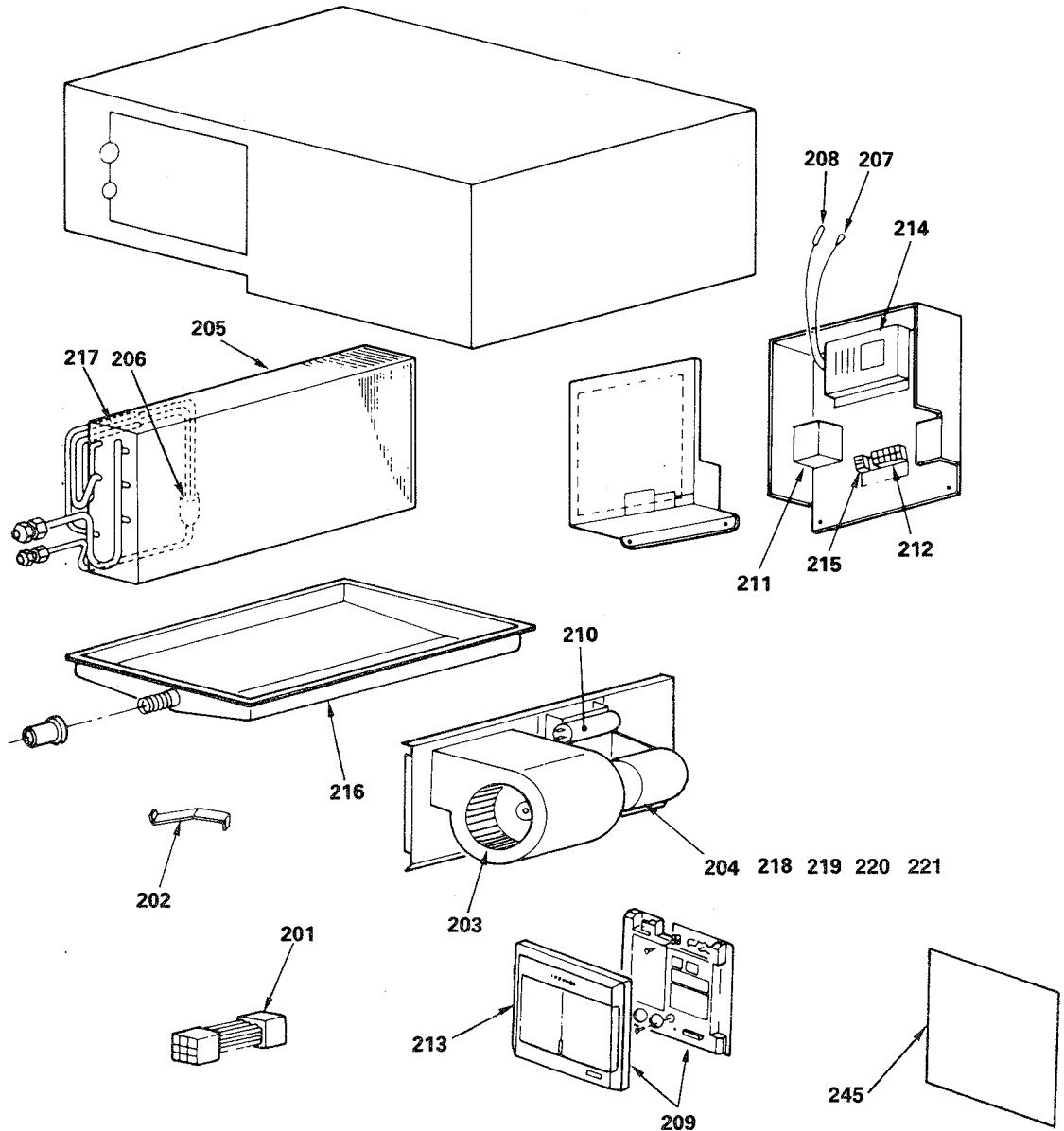
Shelter board is not provided on the indoor unit.

Procure it as shown below at site.



18. EXPLODED VIEWS AND PARTS LISTS

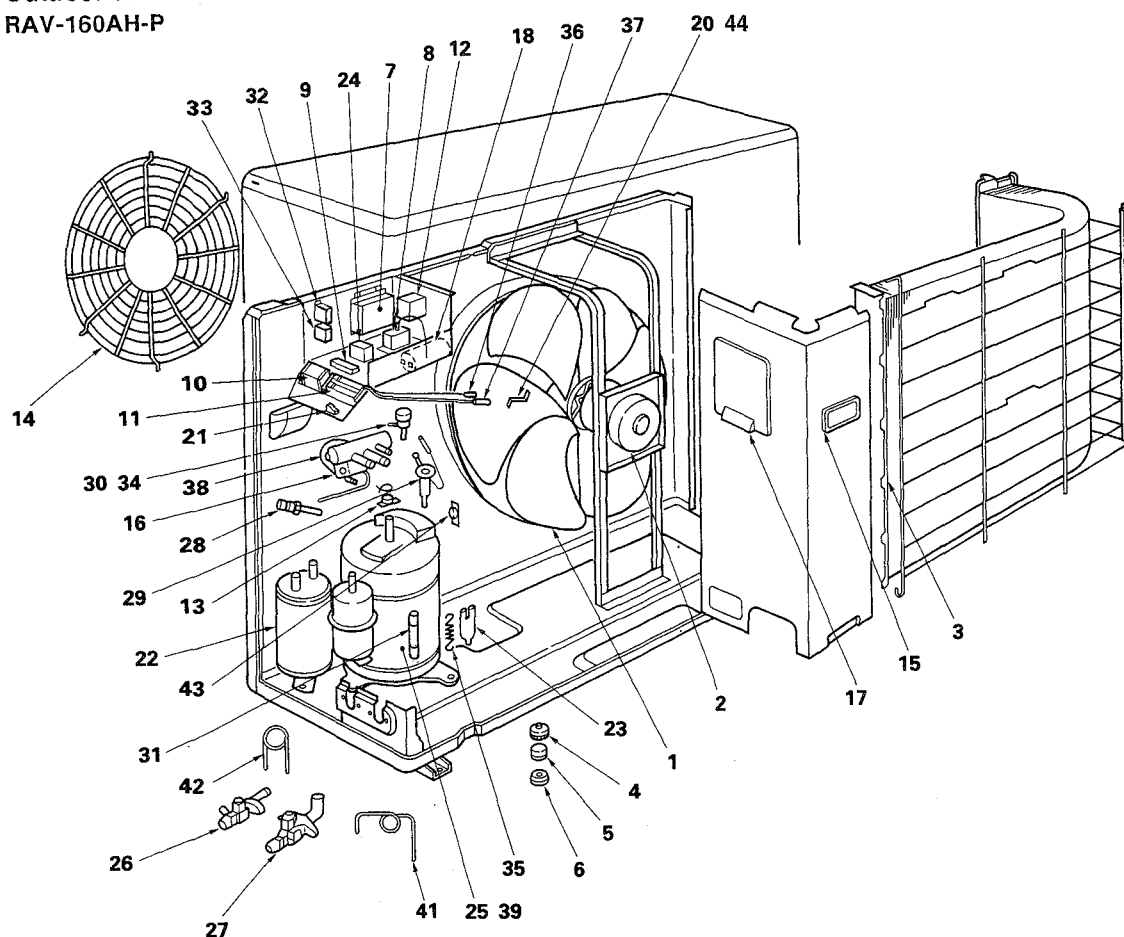
18.1 Indoor unit RAV-161BH-P



Location No.	Part No.	Description
201	43160394	Connector-9P
202	43019604	Holder, Sensor
203	43120149	Fan, Multi-Blade
204	43121520	Motor, Fan, STF-200-60-4A
205	43A44002	Evaporator
206	43A47001	distrubutor (strainer)
207	43050377	Sensor (TA)
208	43150199	Sensor (TC)
209	43169461	Remote Controller
210	43055275	Capacitor, Electrolytic EVM45M305UF
211	43158122	Transformer, Power

Location No.	Part No.	Description
212	43060324	Terminal Block, 3P
213	43162029	Cover, Remocon
214	34169578	PC, Board
215	43160372	Terminal Block, 3P
216	43191304	Drain Pan
217	43047527	Capillary Tube, 2.0DIA
218	43039136	Band, Motor, Left
219	43049137	Band, Motor, Right
220	43039238	Band, Motor, Left
221	43039239	Band, Motor, Right
245	43188836	Owner's Manual, E/G/S/F/I

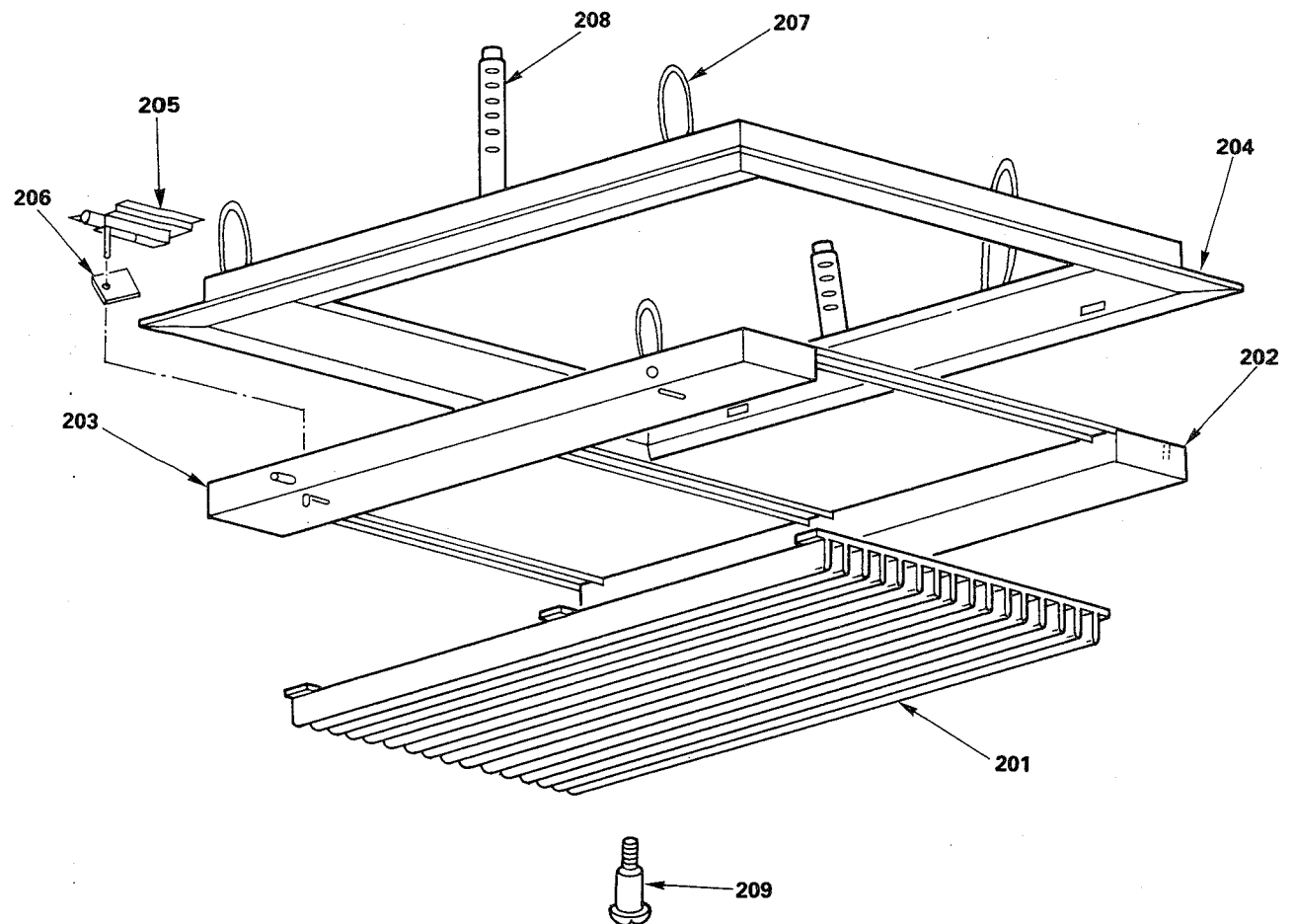
18.2 Outdoor unit RAV-160AH-P



Location No.	Part No.	Description
1	43020156	Fan, Propeller
2	43121473	Motor, Fan, AC, 230V, 50Hz
3	43143641	Condenser
4	43149212	Base, Spring, A
5	43049132	Spring, Buffer
6	43049132	Base, Spring, B
7	4316 9577	PC Board
8	43146387	Switch-High-Pressure
9	43060479	Terminal Block, 4P
10	43160334	Terminal Block, 2P
11	43060324	Terminal Block, 3P
12	43152334	Magnetic, Contactor
13	43054286	Relay, Over Road
14	43191252	Guard-Fan
15	43119368	Hanger
16	43046255	Solenoid Coil
17	43162027	Cover, Electric Parts
18	43155115	Capacitor, Plastic Film, 45MFD, 440V
20	43019604	Holder, Sensor (For TE)
21	43063114	Holder
22	43148105	Accumulator
23	43145082	Dryer

Location No.	Part No.	Description
24	43155080	Capacitor, Electrolytic
25	43041837	Compressor, AC, 220/240V, 50Hz, PH230X3-4 LS
26	43146454	Packed Valve
27	43146406	Packed Valve 1/2 Inch
28	43147321	Check Joint
29	43146424	Expansion Valve
30	43046198	Coil, 2 Way Valve
31	43146283	Checked Valve
32	43154141	Relay
33	43158118	Transformer, Power
34	43146151	2 Way Valve
35	43193043	Spring
36	43150195	Sensor, Cond. Out
37	43150196	Sensor, Heat Exch
38	43146368	4-Way Valve
39	43157167	Heater, Crankcase
41	43146459	Capillary Tube
42	44246235	Capillary Tube
43	43150122	Bimetal Thermostat
44	43107215	Holder, Sensor (For TL)

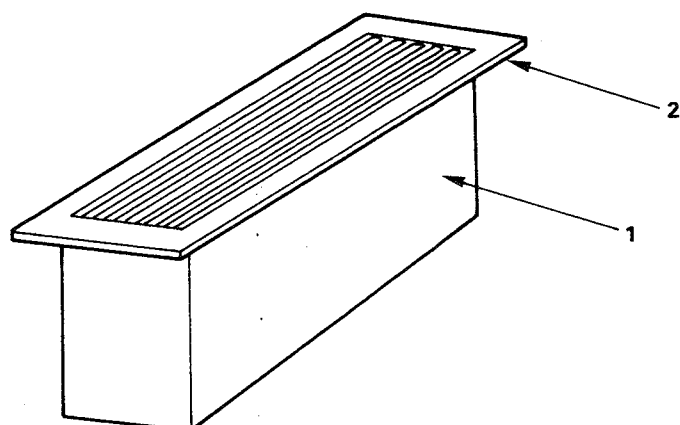
18.3 Ceiling panel
RBC-B161PE(W)



Location No.	Part No.	Description
201	43401585	Inlet Grille
202	43401589	Panel in Right
203	43401593	Panel in Left
204	43102610	Panel Out-Side
205	43407019	Slider

Location No.	Part No.	Description
206	43495584	Packin
207	43497004	Band-A
208	43497005	Band-B
209	43497008	Screw

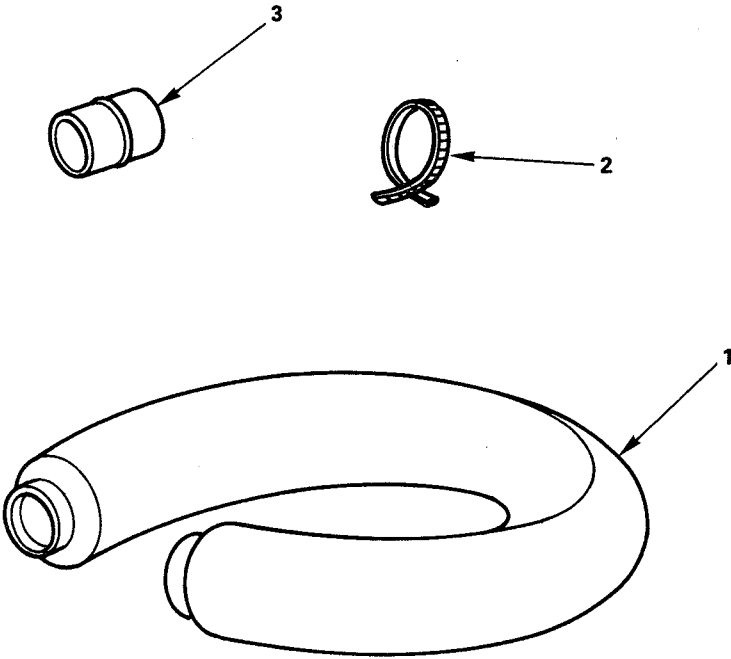
18.4 Blowout unit
RBC-BU1E(W)



Location No.	Part No.	Description
1	43183012	Blowout Chamber

Location No.	Part No.	Description
2	43183013	Panel Outlet

18.5 Flexible duct
RBC-FD202E



Location No.	Part No.	Description
1	43183014	Flexible-duct
2	43183015	Band

Location No.	Part No.	Description
3	43183016	Joint

TOSHIBA CORPORATION
1-1, SHIBAURA 1-CHOME, MINATO-KU, TOKYO 105, JAPAN

AS 80
TOSHIBA

FILE NO. A13-9505
SUPPLEMENT

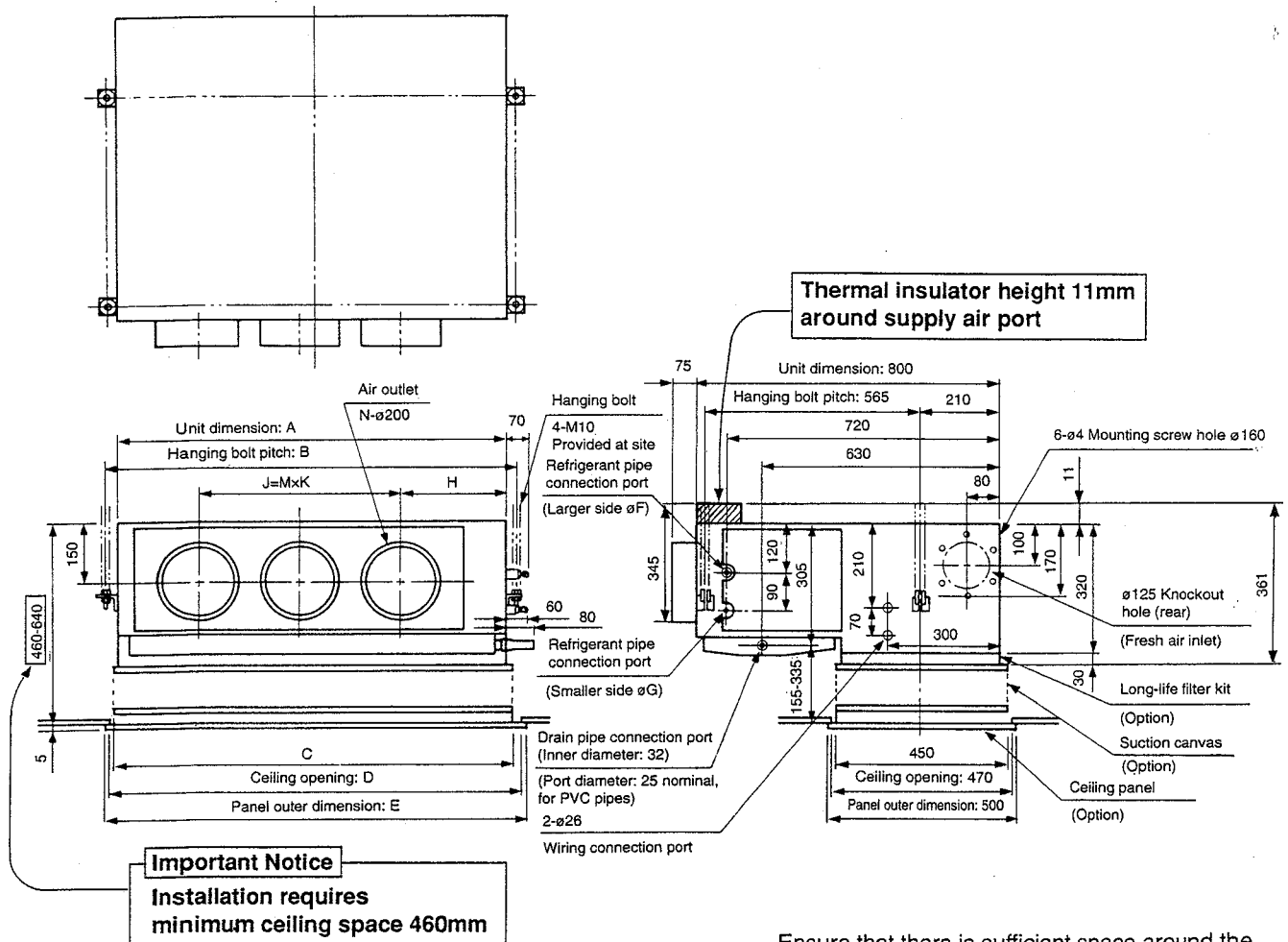
SERVICE MANUAL

AIR-CONDITIONER
SPLIT (BUILT-IN DUCT TYPE)
RAV-161BH-P

– SUMMARY –

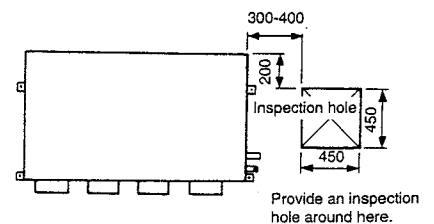
Use this supplement together with the original service manual File No. 300-958.

CONSTRUCTION VIEWS



Ensure that there is sufficient space around the indoor units for installation and servicing.

[Indoor unit]



(Unit: mm)

Model	A	B	F	G	H	J	K	M	N
RAV-161BH-P	700	750	12.7	6.4	252	280	-	-	2